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## TECHNICAL NOTE

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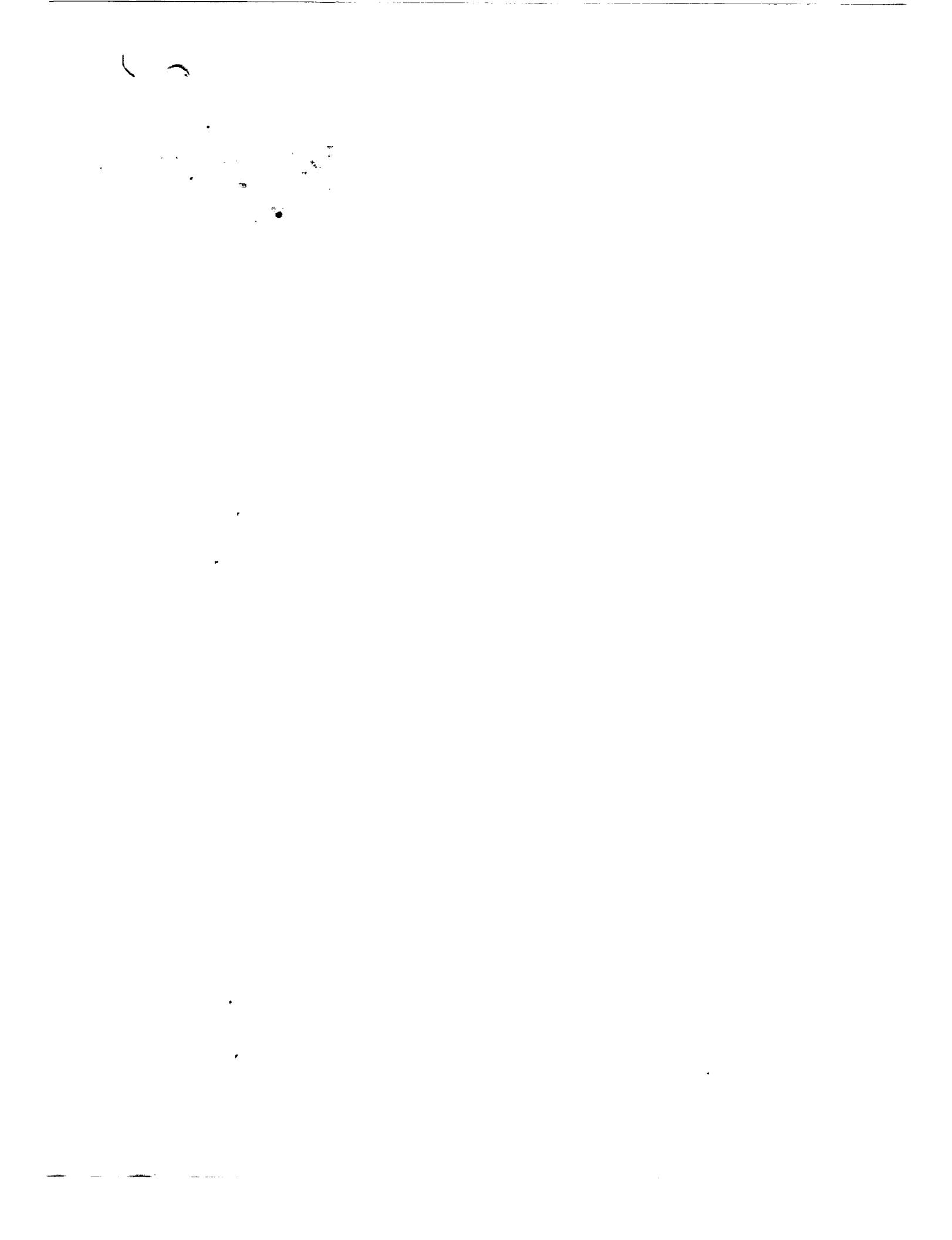
TABULATED VALUES OF BOND DISSOCIATION ENERGIES,  
IONIZATION POTENTIALS, AND ELECTRON AFFINITIES  
FOR SOME MOLECULES FOUND IN HIGH-TEMPERATURE  
CHEMICAL REACTIONS

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
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TABULATED VALUES OF BOND DISSOCIATION ENERGIES,  
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SUMMARY

Values of the bond dissociation energies, ionization potentials, and electron affinities that were taken from the literature are presented in tables for some monatomic, diatomic, and polyatomic molecules which are found in many high-temperature chemical reactions including combustion reactions.

Much of the information came from literature published after 1950 which either reported experimental and theoretical energy values or gave a review of previous literature on the subject. In some cases values for the bond dissociation energies were calculated from recently published heats of formation.

INTRODUCTION

In recent years there has been an increasing interest in knowing the values of bond dissociation energies for diatomic and polyatomic molecules along with ionization potentials and electron affinities for monatomic, diatomic, and polyatomic molecules. These values have been needed by both chemists and physicists when studying chemical reactions at high temperatures, especially when the equilibrium constants had to be calculated for dissociation and ionization of molecules. Use of the ionization potentials and electron affinities of molecules has been made in determining the best materials for adding or removing free electrons in high-temperature gas streams, with applications in the study of magnetohydrodynamic generators and radio attenuation in plasmas.

The primary purpose of this investigation is to tabulate values obtained from existing literature for bond dissociation energies, ionization potentials, and electron affinities for many species present in gas streams as the result of combustion, shock-wave compression, and high-energy electrical discharges or as the result of "seeding" the gas streams with various materials for the production or removal of free electrons. The survey was made by using many values that were reported in recent literature by the individuals who measured the values and also

by using values listed in recent reviews on the subject of dissociation, ionization, and electron affinity.

Many references in the literature have dealt with the structure of molecules as related to the dissociation energy or strength of chemical bonds. Among those studies were references 1 to 5. Several of these, such as references 1, 4, and 5, were surveys of the literature and contained lists of the best available values for the dissociation energies of molecules - both diatomic and polyatomic. Studies on the ionization phenomena in gases have appeared in references such as references 6 to 8 whereas references 9 and 10 are reviews of the ionization potential values for a large number of molecules. The study of negative ions as related to the electron affinity of molecules has been dealt with in references such as references 7 and 11 and reference 12 is a review of the electron affinity values for molecules that were known at the time the reference was written.

#### RESULTS AND DISCUSSION

In tables I, II, and III are presented values of bond dissociation energies, ionization potentials, and electron affinities which have been obtained from existing literature or calculated by use of information in existing literature. (See refs. 1, 4, 5, 6, 9, and 10 to 113.) Where the energy values presented in the tables are not followed by quoted errors, the values are correct to the number of significant figures given or the authors did not report the size of the errors. Parentheses are used to denote approximate values.

The bond dissociation energy values from the literature are presented in table I along with the names of the molecules that are decomposed, the reactions showing the products formed, and the references from which the energy values were obtained. These values are sometimes referred to as  $D(A-B)$  and correspond in thermal measurements to  $\Delta E_0^\circ$ , the heat of the gas-phase reaction  $AB \rightleftharpoons A + B$  which occurs under ideal gas conditions and at a temperature of  $0^\circ K$  and produces molecules A and B in their ground states. The symbol A in this reaction can be one atom or a group of atoms. When diatomic molecules are considered,  $D(A-B)$  is replaced by  $D_0^\circ$ , the dissociation energy, where the subscript refers to the zeroeth vibrational level and the superscript to the products in their ground states. In some cases  $\Delta H_{298}^\circ$ , which is the change in enthalpy or heat content at  $298^\circ K$ , is used for  $D(A-B)$ . This value will be on the order of 1 to 2 kcal/mole (0.04 to 0.09 ev) larger than the true bond dissociation energy but usually the errors involved in the determinations do not warrant any changes in the value of  $\Delta H_{298}^\circ$  to get  $\Delta E_0^\circ$ .

The bond energy  $E$  should not be confused with the bond dissociation energy since bond energy is defined as the strength of a bond as it exists in a molecule before dissociation and is usually found by dividing the atomic heat of formation (heat of atomization) of the molecule  $AB_n$  by the number of bonds n present, provided that all the B's are identical. A discussion of the bond energy compared with the dissociation energy can be found in reference 5. In diatomic molecules

the bond energy is the same as the dissociation energy but in polyatomic molecules this is not true because after the primary bond is broken the strengths of the remaining bonds may change as shown in table I for methane  $\text{CH}_4$  where the energies needed to break each of the bonds are 4.40, 3.8, 5.4, and 3.47 ev, respectively, whereas the bond energy value  $E(\text{C}-\text{H})$  for  $\text{CH}_4$  is on the order of 4.31 ev.

For some reactions shown in table I the dissociation energy values were not found in the literature but were calculated by using the following equation:

$$D(A-B) = \Delta H_f^\circ(A) + \Delta H_f^\circ(B) - \Delta H_f^\circ(AB) \quad (1)$$

based on the reaction  $AB \rightleftharpoons A + B$  where  $\Delta H_f^\circ$  refers to the heat of formation for the various gaseous species at  $0^\circ \text{ K}$ . The values for heats of formation may be found in literature such as references 13 and 14 which deal with thermochemical data pertaining to the combustion of fuels.

Tabulated values from the literature for the ionization potentials of atoms and molecules are presented in table II along with the names and formulas of the neutral species and the appropriate references. The term ionization potential refers to the energy needed to remove the most loosely bound electron from the neutral species in its ground state to form the corresponding molecule-ion or atomic ion also in the ground state. For some of the molecules the method used to determine the value is indicated; that is, spectroscopic technique, photo-ionization technique, or electron impact technique. These methods produce values which are listed for many molecules as a form of comparison. For the atoms the second ionization potential values are included and they refer to the energy required to remove an electron from a singly charged atom in its ground state.

The electron affinity values for several atoms and molecules are presented in table III along with the names and formulas of the neutral species and the references from which they were obtained. The term electron affinity refers to the energy released when an electron is attached to a neutral monatomic, diatomic, or polyatomic molecule and a negative ion is formed. In this case the lowest vibration-rotational level for the ground electronic state of the negative ion is below that of the corresponding neutral molecule and the difference in energy between the two states is called the electron affinity. Only molecules with positive electron affinity values are given since these molecules are considered to be important in reducing the free-electron content of a high-temperature gas stream. For the most part, the molecules with negative electron affinity values form unstable negative ions. In reference 12 some of the electron affinity values are calculated from heats of formation at  $298^\circ \text{ K}$ . These values were not changed since the errors already present in most of the determinations were much larger.

CONCLUDING REMARKS

Bond dissociation energies, ionization potentials, and electron affinity values are presented in tables for some monatomic, diatomic, and polyatomic molecules that are found in high-temperature chemical reactions. These values come from literature published as late as September 1962.

Langley Research Center,  
National Aeronautics and Space Administration,  
Langley Station, Hampton, Va., March 22, 1963.

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TABLE I.- BOND DISSOCIATION ENERGY VALUES

## (a) Inorganic molecules

Name	Reaction	Energy, ev (a)	Reference
Aluminum monobromide	$\text{AlBr} \rightleftharpoons \text{Al} + \text{Br}$	$4.3 \pm 0.2$ 4.55	4 69
Aluminum monocarbide	$\text{AlC} \rightleftharpoons \text{Al} + \text{C}$	b1.65	13
Aluminum monochloride	$\text{AlCl} \rightleftharpoons \text{Al} + \text{Cl}$	$5.1 \pm 0.2$ 5.08	4 69
Aluminum trichloride	$\text{AlCl}_3 \rightleftharpoons \text{AlCl}_2 + \text{Cl}$	b3.93	13
Aluminum monofluoride	$\text{AlF} \rightleftharpoons \text{Al} + \text{F}$	$6.85$ $6.7 \pm 0.3$ 6.77	5 4 69
Aluminum monohydride	$\text{AlH} \rightleftharpoons \text{Al} + \text{H}$	$2.9 \pm 0.2$ 3.06	4 1
Aluminum monoiodide	$\text{AlI} \rightleftharpoons \text{Al} + \text{I}$	$3.92 \pm 0.1$ 3.77	4 69
Aluminum mononitride	$\text{AlN} \rightleftharpoons \text{Al} + \text{N}$	b3.7 ± 0.9	13
Aluminum monoxide	$\text{AlO} \rightleftharpoons \text{Al} + \text{O}$	$4.99 \pm 0.20$ 6.0	30 5
Aluminum monoxide, dimer	$\text{Al}_2\text{O}_2 \rightleftharpoons \text{AlO} + \text{AlO}$	$5.85 \pm 0.20$	30
Aluminum suboxide	$\text{Al}_2\text{O} \rightleftharpoons \text{AlO} + \text{Al}$	$5.68 \pm 0.20$	30
Aluminum oxyhydride	$\text{AlOH} \rightleftharpoons \text{Al} + \text{OH}$ $\text{AlOH} \rightleftharpoons \text{AlO} + \text{H}$	b(3.85) b(3.27)	13 13
Amidogen	$\text{NH}_2 \rightleftharpoons \text{NH} + \text{H}$	b3.9 ± 0.2	13
Ammonia	$\text{NH}_3 \rightleftharpoons \text{NH}_2 + \text{H}$	4.42	5

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Calculated from data in reference.

TABLE I.- BOND DISSOCIATION ENERGY VALUES - Continued

## (a) Inorganic molecules - Continued

Name	Reaction	Energy, ev (a)	Reference
Antimony, diatomic	$Sb_2 \rightleftharpoons Sb + Sb$	$3.0 \pm 0.5$	4
Antimony monochloride	$SbCl \rightleftharpoons Sb + Cl$	$3.7 \pm 0.5$	4
Antimony monofluoride	$SbF \rightleftharpoons Sb + F$	(4.0)	5
Antimony monoxide	$SbO \rightleftharpoons Sb + O$	$3.2 \pm 0.4$	4
Arsenic, diatomic	$As_2 \rightleftharpoons As + As$	3.94	4
Arsenic monoxide	$AsO \rightleftharpoons As + O$	$4.94 \pm 0.13$	67
Barium monochloride	$BaCl \rightleftharpoons Ba + Cl$	$2.2 \pm 0.5$	4
Barium monofluoride	$BaF \rightleftharpoons Ba + F$	(3.0)	5
Barium monohydride	$BaH \rightleftharpoons Ba + H$	$1.8 \pm 0.1$	4
Barium mononitride	$BaN \rightleftharpoons Ba + N$	2.5 to 3.9	98
Barium oxide	$BaO \rightleftharpoons Ba + O$	5.4 4.7 $5.4 \pm 0.5$ $5.64 \pm 0.20$	27 1 4 109
Barium sulfide	$BaS \rightleftharpoons Ba + S$	$2.3 \pm 0.4$	4
Beryllium monochloride	$BeCl \rightleftharpoons Be + Cl$	$5.9 \pm 0.5$	13
Beryllium monofluoride	$BeF \rightleftharpoons Be + F$	$8 \pm 0.5$	13
Beryllium monohydride	$BeH \rightleftharpoons Be + H$	$2.3 \pm 0.3$	4
Beryllium oxide	$BeO \rightleftharpoons Be + O$	$4.6 \pm 0.1$ $5.4 \pm 0.7$	66 4
Bismuth, diatomic	$Bi_2 \rightleftharpoons Bi + Bi$	1.70	1

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Calculated from data in reference.

TABLE I.- BOND DISSOCIATION ENERGY VALUES - Continued

## (a) Inorganic molecules - Continued

Name	Reaction	Energy, ev (a)	Reference
Bismuth monobromide	$\text{BiBr} \rightleftharpoons \text{Bi} + \text{Br}$	$2.74 \pm 0.01$	4
Bismuth monochloride	$\text{BiCl} \rightleftharpoons \text{Bi} + \text{Cl}$	$2.9 \pm 0.2$	4
Bismuth monofluoride	$\text{BiF} \rightleftharpoons \text{Bi} + \text{F}$	$3.2 \pm 0.4$	4
Bismuth monohydride	$\text{BiH} \rightleftharpoons \text{Bi} + \text{H}$	$2.5 \pm 0.3$	4
Bismuth oxide	$\text{BiO} \rightleftharpoons \text{Bi} + \text{O}$	(3.7) 3.39	5 27
Boron, diatomic	$\text{B}_2 \rightleftharpoons \text{B} + \text{B}$	3.6 $3.0 \pm 0.5$ $2.85 \pm 0.24$	79 4 101
Boron monobromide	$\text{BBr} \rightleftharpoons \text{B} + \text{Br}$	4.49 $4.2 \pm 0.2$	69 4
Boron monochloride	$\text{BCl} \rightleftharpoons \text{B} + \text{Cl}$	$5.1 \pm 0.4$ 5.5	4 69
Boron monofluoride	$\text{BF} \rightleftharpoons \text{B} + \text{F}$	4.45 $8.5 \pm 0.5$ 8.0	79 4 69
Boron trifluoride	$\text{BF}_3 \rightleftharpoons \text{BF}_2 + \text{F}$	b6.65 ± 0.30	13
Boron monohydride	$\text{BH} \rightleftharpoons \text{B} + \text{H}$	3.54 $3.0 \pm 0.4$	79 4
Boron trihydride	$\text{BH}_3 \rightleftharpoons \text{BH} + \text{H}_2$	b4.1 ± 0.4	13
Boron nitride	$\text{BN} \rightleftharpoons \text{B} + \text{N}$	4.96 $4.0 \pm 0.5$	79 4

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Calculated from data in reference.

TABLE I.- BOND DISSOCIATION ENERGY VALUES - Continued

## (a) Inorganic molecules - Continued

Name	Reaction	Energy, ev <sup>a</sup>	Reference
Boron monoxide	$\text{BO} \rightleftharpoons \text{B} + \text{O}$	7.27 7.6 ± 0.4 5.46 ± 0.06 (8.0)	79 4 67 5
Boron sulfide	$\text{BS} \rightleftharpoons \text{B} + \text{S}$	5.1 ± 0.8	4
Bromine	$\text{Br}_2 \rightleftharpoons \text{Br} + \text{Br}$	1.971	1
Bromine chloride	$\text{BrCl} \rightleftharpoons \text{Br} + \text{Cl}$	2.26	1
Bromine fluoride	$\text{BrF} \rightleftharpoons \text{Br} + \text{F}$	2.16 ± 0.07	4
Bromine monoxide	$\text{BrO} \rightleftharpoons \text{Br} + \text{O}$	1.8 ± 0.5	4
Cadmium monohydride	$\text{CdH} \rightleftharpoons \text{Cd} + \text{H}$	0.678 ± 0.009	4
Cadmium oxide	$\text{CdO} \rightleftharpoons \text{Cd} + \text{O}$	< 3.8	4
Cadmium sulfide	$\text{CdS} \rightleftharpoons \text{Cd} + \text{S}$	5.9 ± 0.2	4
Calcium monochloride	$\text{CaCl} \rightleftharpoons \text{Ca} + \text{Cl}$	≤ 2.76	4
Calcium monofluoride	$\text{CaF} \rightleftharpoons \text{Ca} + \text{F}$	≤ 3.15	4
Calcium monohydride	$\text{CaH} \rightleftharpoons \text{Ca} + \text{H}$	≤ 1.70	4
Calcium mononitride	$\text{CaN} \rightleftharpoons \text{Ca} + \text{N}$	2.2 to 4.0	98
Calcium oxide	$\text{CaO} \rightleftharpoons \text{Ca} + \text{O}$	3.93 5.9 4.4 ± 0.6 4.7 ± 0.5	27 3 5 4
Calcium sulfide	$\text{CaS} \rightleftharpoons \text{Ca} + \text{S}$	5.0 ± 0.5	4

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Calculated from data in reference.

TABLE I.- BOND DISSOCIATION ENERGY VALUES - Continued

## (a) Inorganic molecules - Continued

Name	Reaction	Energy, ev (a)	Reference
Carbon, diatomic	$C_2 \rightleftharpoons C + C$	4.9 ± 0.3 6.25 ± 0.2 6.5 6.07 6.11	4 17 5 79 45
Carbon monoxide	$CO \rightleftharpoons C + O$ $CO^+ \rightleftharpoons C^+ + O$	11.11 ± 0.01 8.43 ± 0.02	4 4
Carbon dioxide	$CO_2 \rightleftharpoons CO + O$	5.45 5.5	79 5
Carbon phosphide	$CP \rightleftharpoons C + P$	5.43 (6.9) (6.0)	27 1 5
Carbon monosulfide	$CS \rightleftharpoons C + S$	7.90 7.2 ± 1.0	27 4
Carbon disulfide	$CS_2 \rightleftharpoons CS + S$	b4.68	13
Carbonyl sulfide	$COS \rightleftharpoons CO + S$	3.09	79
Cerium oxide	$CeO \rightleftharpoons Ce + O$	(6.5)	5
Cesium, diatomic	$Cs_2 \rightleftharpoons Cs + Cs$	0.45	1
Cesium bromide	$CsBr \rightleftharpoons Cs + Br$ $CsBr \rightleftharpoons Cs^+ + Br^-$	4.31 ± 0.12 3.95 4.59	48 5 53
Cesium chloride	$CsCl \rightleftharpoons Cs + Cl$ $CsCl \rightleftharpoons Cs^+ + Cl^-$	4.65 ± 0.12 4.38 4.77	48 5 53

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Calculated from data in reference.

TABLE I.- BOND DISSOCIATION ENERGY VALUES - Continued

## (a) Inorganic molecules - Continued

Name	Reaction	Energy, ev (a)	Reference
Cesium fluoride	$\text{CsF} \rightleftharpoons \text{Cs} + \text{F}$	$5.33 \pm 0.33$	48
		$5.5 \pm 0.2$	4
		5.25	5
	$\text{CsF} \rightleftharpoons \text{Cs}^+ + \text{F}^-$	5.55	53
Cesium hydride	$\text{CsH} \rightleftharpoons \text{Cs} + \text{H}$	$1.8 \pm 0.3$	4
Cesium hydroxide	$\text{CsOH} \rightleftharpoons \text{Cs} + \text{OH}$	3.95	81
Cesium iodide	$\text{CsI} \rightleftharpoons \text{Cs} + \text{I}$	3.37	1
		$3.63 \pm 0.16$	48
		3.25	5
	$\text{CsI} \rightleftharpoons \text{Cs}^+ + \text{I}^-$	4.29	53
Cesium nitride	$\text{CsN} \rightleftharpoons \text{Cs} + \text{N}$	3.1 to 4.2	98
Cesium monoxide	$\text{CsO} \rightleftharpoons \text{Cs} + \text{O}$	3.47	81
Chlorine	$\text{Cl}_2 \rightleftharpoons \text{Cl} + \text{Cl}$	2.475	1
	$\text{Cl}_2^+ \rightleftharpoons \text{Cl} + \text{Cl}^+$	$4.2 \pm 0.3$	4
Chlorine fluoride	$\text{FCl} \rightleftharpoons \text{F} + \text{Cl}$	2.616	1
Chlorine monoxide	$\text{ClO} \rightleftharpoons \text{Cl} + \text{O}$	1.9	79
		$2.73 \pm 0.03$	4
Chlorine dioxide	$\text{ClO}_2 \rightleftharpoons \text{Cl} + \text{O}_2$	$5.26 \pm 0.09$	68
	$\text{ClO}_2 \rightleftharpoons \text{ClO} + \text{O}$	2.5	5
Chlorine trioxide	$\text{ClO}_3 \rightleftharpoons \text{Cl} + \text{O}_3$	$6.81 \pm 0.10$	67
Chlorine oxide	$\text{Cl}_2\text{O} \rightleftharpoons 2\text{Cl} + \text{O}$	$4.08 \pm 0.10$	67
Chromium monoxide	$\text{CrO} \rightleftharpoons \text{Cr} + \text{O}$	$4.2 \pm 0.5$	4
Copper, diatomic	$\text{Cu}_2 \rightleftharpoons \text{Cu} + \text{Cu}$	2.0 <sup>b</sup>	5

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Calculated from data in reference.

TABLE I.- BOND DISSOCIATION ENERGY VALUES - Continued

## (a) Inorganic molecules - Continued

Name	Reaction	Energy, ev (a)	Reference
Copper monobromide	$\text{CuBr} \rightleftharpoons \text{Cu} + \text{Br}$	$3.4 \pm 0.25$	4
Copper monochloride	$\text{CuCl} \rightleftharpoons \text{Cu} + \text{Cl}$	$3.7 \pm 0.25$	4
Copper monofluoride	$\text{CuF} \rightleftharpoons \text{Cu} + \text{F}$	3.0	5
Copper monohydride	$\text{CuH} \rightleftharpoons \text{Cu} + \text{H}$	2.86	5
Copper hydroxide	$\text{CuOH} \rightleftharpoons \text{Cu} + \text{OH}$	2.65	5
Copper oxide	$\text{CuO} \rightleftharpoons \text{Cu} + \text{O}$	$4.9 \pm 0.5$	4
Cyano	$\text{CN} \rightleftharpoons \text{C} + \text{N}$	7.55 ± 0.11 8.48 8.2 ± 0.2 7.6 8.1 ± 0.3 7.5 ± 0.1	16 27 25 79 4 86
Cyanoacetylene	$\text{HC}_3\text{N} \rightleftharpoons \text{C}_2\text{H} + \text{CN}$ $\text{HC}_3\text{N} \rightleftharpoons \text{C}_3\text{H} + \text{N}$	5.2 6.8	37 37
Cyanogen	$\text{C}_2\text{N}_2 \rightleftharpoons \text{C}_2\text{N} + \text{N}$ $\text{C}_2\text{N}_2 \rightleftharpoons \text{CN} + \text{CN}$	7.0 6.29 ± 0.25 6.13 4.51 4.86 4.64 ± 0.2 5.51 ± 0.10 5.20 ± 0.35 5.05 ± 0.45 5.42 ± 0.35	37 16 79 37 5 39 54 55 4 75
-----	$\text{C}_2\text{N} \rightleftharpoons \text{CN} + \text{C}$	6.76	37
Cyanogen bromide	$\text{CNBr} \rightleftharpoons \text{CN} + \text{Br}$	(3.6)	96

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Calculated from data in reference.

TABLE I.- BOND DISSOCIATION ENERGY VALUES - Continued

## (a) Inorganic molecules - Continued

Name	Reaction	Energy, ev ( <sup>a</sup> )	Reference
Cyanogen chloride	$\text{CNCI} \rightleftharpoons \text{CN} + \text{Cl}$	$5.6 \pm 0.2$ b <sub>14.0</sub>	59 14
Cyanogen fluoride	$\text{CNF} \rightleftharpoons \text{F} + \text{CN}$	b <sub>2.7</sub>	14
Cyanogen iodide	$\text{CNI} \rightleftharpoons \text{CN} + \text{I}$	(5.0)	20
Deuterium	$\text{D}_2 \rightleftharpoons \text{D} + \text{D}$	b <sub>1.87</sub>	+
Diborane	$\text{B}_2\text{H}_6 \rightleftharpoons \text{BH}_3 + \text{BH}_3$	$1.25 \pm 0.05$	44
Diboron dioxide	$\text{B}_2\text{O}_2 \rightleftharpoons \text{BO} + \text{BO}$	>4.5	105
Dicyanoacetylene	$\text{C}_4\text{N}_2 \rightleftharpoons \text{C}_2\text{N} + \text{C}_2\text{N}$ $\text{C}_4\text{N}_2 \rightleftharpoons \text{C}_2\text{N} + \text{CN}$	5.1 4.0	57 57
Dicyanodiacetylene	$\text{C}_6\text{N}_2 \rightleftharpoons \text{C}_5\text{N} + \text{C}_3\text{N}$ $\text{C}_6\text{N}_2 \rightleftharpoons \text{C}_4\text{N} + \text{C}_2\text{N}$	2.42 4.3	57 57
Difluoroamino	$\text{NF}_2 \rightleftharpoons \text{NF} + \text{F}$	(3.08)	15
Difluorodiazene (trans)	trans $\text{N}_2\text{F}_2 \rightleftharpoons 2\text{NF}$	$4.5 \pm 0.4$	84
Fluorine	$\text{F}_2 \rightleftharpoons \text{F} + \text{F}$ $\text{F}_2^+ \rightleftharpoons \text{F} + \text{F}^+$	$1.609 \pm 0.057$ 3.18	59 25
Gallium monochloride	$\text{GaCl} \rightleftharpoons \text{Ga} + \text{Cl}$	$4.94 \pm 0.17$	48
Gallium monofluoride	$\text{GaF} \rightleftharpoons \text{Ga} + \text{F}$	6.24	69
Gallium monoxide	$\text{GaO} \rightleftharpoons \text{Ga} + \text{O}$	$2.52 \pm 0.50$	67
Germanium, diatomic	$\text{Ge}_2 \rightleftharpoons \text{Ge} + \text{Ge}$	2.8	5

<sup>a</sup>Approximate values shown in parentheses.

bCalculated from data in reference.

TABLE I.- BOND DISSOCIATION ENERGY VALUES - Continued

## (a) Inorganic molecules - Continued

Name	Reactions	Energy, ev (a)	Reference
Germanium monoxide	$\text{GeO} \rightleftharpoons \text{Ge} + \text{O}$	6.8	5
Germanium monosulfide	$\text{GeS} \rightleftharpoons \text{Ge} + \text{S}$	$5.66 \pm 0.13$	4
Hydrazine	$\text{N}_2\text{H}_4 \rightleftharpoons \text{NH}_2 + \text{NH}_2$	$2.6 \pm 0.2$	5
	$\text{N}_2\text{H}_4 \rightleftharpoons \text{N}_2\text{H}_3 + \text{H}$	$3.30 \pm 0.20$	42
Hydrogen	$\text{H}_2 \rightleftharpoons \text{H} + \text{H}$	4.476	1
	$\text{H}_2^+ \rightleftharpoons \text{H} + \text{H}^+$	2.648	1
Hydrogen bromide	$\text{HBr} \rightleftharpoons \text{H} + \text{Br}$	3.754	1
Hydrogen chloride	$\text{HCl} \rightleftharpoons \text{H} + \text{Cl}$	4.431	4
Hydrogen cyanide	$\text{HCN} \rightleftharpoons \text{H} + \text{CN}$	$5.59 \pm 0.11$	16
		4.94	5
		$4.81 \pm 0.1$	39
Hydrogen deuteride	$\text{HD} \rightleftharpoons \text{H} + \text{D}$	4.5133	4
Hydrogen fluoride	$\text{HF} \rightleftharpoons \text{H} + \text{F}$	5.86	13
		5.79	79
		$5.81 \pm 0.10$	5
Hydrogen iodide	$\text{HI} \rightleftharpoons \text{H} + \text{I}$	3.056	1
Hydrogen oxybromide	$\text{HOBr} \rightleftharpoons \text{HO} + \text{Br}$	2.43	5
Hydrogen oxychloride	$\text{HOCl} \rightleftharpoons \text{OH} + \text{Cl}$	2.60	5
Hydrogen peroxide	$\text{H}_2\text{O}_2 \rightleftharpoons \text{OH} + \text{OH}$	$2.07 \pm 0.10$	31
		$2.10 \pm 0.11$	46
	$\text{H}_2\text{O}_2 \rightleftharpoons \text{HO}_2 + \text{H}$	$3.83 \pm 0.09$	90
Hydrogen persulfide	$\text{H}_2\text{S}_2 \rightleftharpoons \text{SH} + \text{SH}$	2.95	5
		$2.6 \pm 0.1$	100

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Calculated from data in reference.

TABLE I.- BOND DISSOCIATION ENERGY VALUES - Continued

## (a) Inorganic molecules - Continued

Name	Reactions	Energy, ev (a)	Reference
Hydrogen monosulfide	$\text{SH} \rightleftharpoons \text{S} + \text{H}$	3.59 3.65 $3.85 \pm 0.2$	27 79 4
Hydrogen sulfide	$\text{H}_2\text{S} \rightleftharpoons \text{H} + \text{SH}$	3.92 (3.9)	27 5
Hydroperoxy	$\text{HO}_2 \rightleftharpoons \text{H} + \text{O}_2$	$2.04 \pm 0.1$ $1.99 \pm 0.09$	40 90
Hydroxyl	$\text{OH} \rightleftharpoons \text{O} + \text{H}$ $\text{OH}^+ \rightleftharpoons \text{O} + \text{H}^+$	4.393 4.35 $4.45 \pm 0.2$ 4.40 $\geq 4.4$	27 1 4 5 1
Hypoiodous acid	$\text{HOI} \rightleftharpoons \text{HO} + \text{I}$	$2.4 \pm 0.1$	5
Imidogen	$\text{NH} \rightleftharpoons \text{N} + \text{H}$	3.78 $3.7 \pm 0.5$	79 4
Indium monochloride	$\text{InCl} \rightleftharpoons \text{In} + \text{Cl}$	4.44	69
Indium monofluoride	$\text{InF} \rightleftharpoons \text{In} + \text{F}$	5.46	69
Indium monohydride	$\text{InH} \rightleftharpoons \text{In} + \text{H}$	$2.5 \pm 0.1$	4
Indium oxide	$\text{InO} \rightleftharpoons \text{In} + \text{O}$	$1.1 \pm 0.2$	4
Iodine	$\text{I}_2 \rightleftharpoons \text{I} + \text{I}$	1.5417	1
Iodine bromide	$\text{IBr} \rightleftharpoons \text{I} + \text{Br}$	1.817	1
Iodine chloride	$\text{ICl} \rightleftharpoons \text{I} + \text{Cl}$	2.152	1
Iodine fluoride	$\text{IF} \rightleftharpoons \text{I} + \text{F}$	$1.98 \pm 0.05$	4
Iodine monoxide	$\text{IO} \rightleftharpoons \text{I} + \text{O}$	$1.9 \pm 0.2$	4

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Calculated from data in reference.

TABLE I. - BOND DISSOCIATION ENERGY VALUES - Continued

## (a) Inorganic molecules - Continued

Name	Reactions	Energy, ev (a)	Reference
Iron monoxide	$\text{FeO} \rightleftharpoons \text{Fe} + \text{O}$	(4.0)	5
Lanthanum monoxide	$\text{LaO} \rightleftharpoons \text{La} + \text{O}$	$8.15 \pm 0.55$	106
Lead, diatomic	$\text{Pb}_2 \rightleftharpoons \text{Pb} + \text{Pb}$	1.0	5
Lead monochloride	$\text{PbCl} \rightleftharpoons \text{Pb} + \text{Cl}$	$3.1 \pm 0.3$	4
Lead monohydride	$\text{PbH} \rightleftharpoons \text{Pb} + \text{H}$	$1.8 \pm 0.2$	4
Lead monoxide	$\text{PbO} \rightleftharpoons \text{Pb} + \text{O}$	$4.1 \pm 0.5$	4
Lithium, diatomic	$\text{Li}_2 \rightleftharpoons \text{Li} + \text{Li}$	1.03 $1.10 \pm 0.05$	1 4
Lithium bromide	$\text{LiBr} \rightleftharpoons \text{Li} + \text{Br}$ $\text{LiBr} \rightleftharpoons \text{Li}^+ + \text{Br}^-$	4.53 $4.36 \pm 0.12$ $4.35 \pm 0.3$ 6.24	1 48 4 53
Lithium chloride	$\text{LiCl} \rightleftharpoons \text{Li} + \text{Cl}$ $\text{LiCl} \rightleftharpoons \text{Li}^+ + \text{Cl}^-$	5.1 $4.79 \pm 0.12$ $5.0 \pm 0.3$ 6.50	1 48 4 53
Lithium fluoride	$\text{LiF} \rightleftharpoons \text{Li} + \text{F}$ $\text{LiF} \rightleftharpoons \text{Li}^+ + \text{F}^-$	$5.90 \pm 0.33$ $5.95 \pm 0.5$ 7.83	48 4 53
Lithium hydride	$\text{LiH} \rightleftharpoons \text{Li} + \text{H}$	2.429 $2.5 \pm 0.2$	27 4
Lithium hydroxide	$\text{LiOH} \rightleftharpoons \text{Li} + \text{OH}$	4.42	81
Lithium iodide	$\text{LiI} \rightleftharpoons \text{Li} + \text{I}$	3.58 $3.57 \pm 0.12$ $3.5 \pm 0.2$	1 48 4

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Calculated from data in reference.

TABLE I.- BOND DISSOCIATION ENERGY VALUES - Continued

## (a) Inorganic molecules - Continued

Name	Reactions	Energy, ev (a)	Reference
Lithium iodide	$\text{LiI} \rightleftharpoons \text{Li}^+ + \text{I}^-$	5.85	53
Lithium mononitride	$\text{LiN} \rightleftharpoons \text{Li} + \text{N}$	b(4.86)	13
Lithium monoxide	$\text{LiO} \rightleftharpoons \text{Li} + \text{O}$	<3.6	81
Lithium oxide	$\text{Li}_2\text{O} \rightleftharpoons 2\text{Li} + \text{O}$	b(7.3)	13
Magnesium monochloride	$\text{MgCl} \rightleftharpoons \text{Mg} + \text{Cl}$	$2.7 \pm 0.7$	4
Magnesium monofluoride	$\text{MgF} \rightleftharpoons \text{Mg} + \text{F}$	$3.2 \pm 0.7$	4
Magnesium monohydride	$\text{MgH} \rightleftharpoons \text{Mg} + \text{H}$	$2.0 \pm 0.5$ $\leq 2.49$	4 1
Magnesium mononitride	$\text{MgN} \rightleftharpoons \text{Mg} + \text{N}$	2.0 to 4.4	98
Magnesium oxide	$\text{MgO} \rightleftharpoons \text{Mg} + \text{O}$	$4.48$ (4.0) $4.5 \pm 0.7$	27 5 4
Manganese monoxide	$\text{MnO} \rightleftharpoons \text{Mn} + \text{O}$	$4.0 \pm 0.4$	67
Mercury, diatomic	$\text{Hg}_2 \rightleftharpoons \text{Hg} + \text{Hg}$	0.06	4
Mercury monochloride	$\text{HgCl} \rightleftharpoons \text{Hg} + \text{Cl}$	$1.0 \pm 0.1$	4
Mercury monofluoride	$\text{HgF} \rightleftharpoons \text{Hg} + \text{F}$	$1.4 \pm 0.5$	4
Mercury monohydride	$\text{HgH} \rightleftharpoons \text{Hg} + \text{H}$	0.372	4
Mercury sulfide	$\text{HgS} \rightleftharpoons \text{Hg} + \text{S}$	$2.8 \pm 0.2$	4
Molybdenum oxide	$\text{MoO} \rightleftharpoons \text{Mo} + \text{O}$	$5.0 \pm 0.7$	58
Nickel monochloride	$\text{NiCl} \rightleftharpoons \text{Ni} + \text{Cl}$	$3.82 \pm 0.20$	48

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Calculated from data in reference.

TABLE I.- BOND DISSOCIATION ENERGY VALUES - Continued

## (a) Inorganic molecules - Continued

Name	Reactions	Energy, ev (a)	Reference
Nickel monohydride	$\text{NiH} \rightleftharpoons \text{Ni} + \text{H}$	$2.6 \pm 0.3$	4
Nickel oxide	$\text{NiO} \rightleftharpoons \text{Ni} + \text{O}$	$<4.4$	67
Niobium oxide	$\text{NbO} \rightleftharpoons \text{Nb} + \text{O}$	(4.0)	5
Nitric oxide	$\text{NO} \rightleftharpoons \text{N} + \text{O}$ $\text{NO}^+ \rightleftharpoons \text{N} + \text{O}^+$	$6.49 \pm 0.05$ 10.6	4 1
Nitrogen	$\text{N}_2 \rightleftharpoons \text{N} + \text{N}$ $\text{N}_2^+ \rightleftharpoons \text{N} + \text{N}^+$	9.762 8.73	4
Nitrogen monofluoride	$\text{NF} \rightleftharpoons \text{N} + \text{F}$	(3.08)	15
Nitrogen trifluoride	$\text{NF}_3 \rightleftharpoons \text{NF}_2 + \text{F}$	$2.47 \pm 0.08$	15
Nitrogen dioxide	$\text{NO}_2 \rightleftharpoons \text{NO} + \text{O}$	3.13	5
Nitrogen trioxide	$\text{N}_2\text{O}_3 \rightleftharpoons \text{NO}_2 + \text{NO}$	0.43	5
Nitrogen tetraoxide	$\text{N}_2\text{O}_4 \rightleftharpoons \text{NO}_2 + \text{NO}_2$	0.56	5
Nitrosyl chloride	$\text{NOCl} \rightleftharpoons \text{NO} + \text{Cl}$	1.60	5
Nitrous oxide	$\text{N}_2\text{O} \rightleftharpoons \text{N} + \text{NO}$ $\text{N}_2\text{O} \rightleftharpoons \text{N}_2 + \text{O}$	$\leq 4.50$ $\leq 1.34$ $1.2 \pm 0.2$	20 20 26
Oxygen	$\text{O}_2 \rightleftharpoons \text{O} + \text{O}$ $\text{O}_2^+ \rightleftharpoons \text{O} + \text{O}^+$	5.115 $6.48 \pm 0.1$	5 4
Oxygen fluoride	$\text{OF} \rightleftharpoons \text{O} + \text{F}$	1.1	43
Oxygen difluoride	$\text{OF}_2 \rightleftharpoons \text{FO} + \text{F}$	2.8	43

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Calculated from data in reference.

TABLE I.- BOND DISSOCIATION ENERGY VALUES - Continued

## (a) Inorganic molecules - Continued

Name	Reactions	Energy, ev (a)	Reference
Ozone	$O_3 \rightleftharpoons O_2 + O$	1.06	34
Perchloryl fluoride	$O_3ClF \rightleftharpoons ClO_3 + F$ $O_3ClF \rightleftharpoons ClO_2 + O + F$ $O_3ClF \rightleftharpoons ClO + 2O + F$	2.6 4.6 7.6	52 52 52
Phosphorus, diatomic	$P_2 \rightleftharpoons P + P$	5.031	79
Phosphorus monohydride	$PH \rightleftharpoons P + H$	3.32 3.3	27 79
Phosphorus mononitride	$PN \rightleftharpoons P + N$	7.09 $6.0 \pm 0.8$	27 4
Phosphorus monoxide	$PO \rightleftharpoons P + O$	5.4 $6.2 \pm 0.5$	27 4
Phosphorus oxychloride	$OPCl_3 \rightleftharpoons PCl_3 + O$	$5.28 \pm 0.10$	5
Potassium, diatomic	$K_2 \rightleftharpoons K + K$	0.514	1
Potassium bromide	$KBr \rightleftharpoons K + Br$ $KBr \rightleftharpoons K^+ + Br^-$	3.96 $3.93 \pm 0.10$ $3.94 \pm 0.05$ 4.77	1 48 4 53
Potassium chloride	$KCl \rightleftharpoons K + Cl$ $KCl \rightleftharpoons K^+ + Cl^-$	$4.40 \pm 0.05$ $4.32 \pm 0.10$ 4.38 4.99	4 48 5 53
Potassium fluoride	$KF \rightleftharpoons K + F$ $KF \rightleftharpoons K^+ + F^-$	$5.07 \pm 0.33$ $5.0 \pm 0.25$ 5.12 5.90	48 4 5 53

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Calculated from data in reference.

TABLE I.- BOND DISSOCIATION ENERGY VALUES - Continued

## (a) Inorganic molecules - Continued

Name	Reactions	Energy, ev (a)	Reference
Potassium hydride	$\text{KH} \rightleftharpoons \text{K} + \text{H}$	$1.86 \pm 0.15$	4
Potassium hydroxide	$\text{KOH} \rightleftharpoons \text{K} + \text{OH}$	3.73	81
Potassium iodide	$\text{KI} \rightleftharpoons \text{K} + \text{I}$	$3.32 \pm 0.05$	4
		$3.48 \pm 0.12$	48
		3.34	5
	$\text{KI} \rightleftharpoons \text{K}^+ + \text{I}^-$	4.50	53
Potassium nitride	$\text{KN} \rightleftharpoons \text{K} + \text{N}$	3.4 to 4.8	98
Potassium monoxide	$\text{KO} \rightleftharpoons \text{K} + \text{O}$	3.51	81
Rubidium, diatomic	$\text{Rb}_2 \rightleftharpoons \text{Rb} + \text{Rb}$	0.49	1
Rubidium bromide	$\text{RbBr} \rightleftharpoons \text{Rb} + \text{Br}$	3.93	1
		$3.97 \pm 0.10$	48
		3.90	5
	$\text{RbBr} \rightleftharpoons \text{Rb}^+ + \text{Br}^-$	4.58	53
Rubidium chloride	$\text{RbCl} \rightleftharpoons \text{Rb} + \text{Cl}$	4.42	5
		$4.40 \pm 0.10$	48
		4.5 ± 0.2	4
	$\text{RbCl} \rightleftharpoons \text{Rb}^+ + \text{Cl}^-$	4.77	53
Rubidium fluoride	$\text{RbF} \rightleftharpoons \text{Rb} + \text{F}$	$5.20 \pm 0.33$	48
		$5.35 \pm 0.2$	4
		5.16	5
	$\text{RbF} \rightleftharpoons \text{Rb}^+ + \text{F}^-$	5.68	53
Rubidium hydride	$\text{RbH} \rightleftharpoons \text{Rb} + \text{H}$	$1.7 \pm 0.2$	4
Rubidium iodide	$\text{RbI} \rightleftharpoons \text{Rb} + \text{I}$	3.29	1
		$3.52 \pm 0.10$	48
		$3.35 \pm 0.1$	4
	$\text{RbI} \rightleftharpoons \text{Rb}^+ + \text{I}^-$	4.31	53
Rubidium nitride	$\text{RbN} \rightleftharpoons \text{Rb} + \text{N}$	3.0 to 4.2	98

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Calculated from data in reference.

TABLE I.- BOND DISSOCIATION ENERGY VALUES - Continued

## (a) Inorganic molecules - Continued

Name	Reactions	Energy, ev (a)	Reference
Rubidium monoxide	$\text{RbO} \rightleftharpoons \text{Rb} + \text{O}$	3.42	81
Scandium oxide	$\text{ScO} \rightleftharpoons \text{Sc} + \text{O}$	(6.0)	5
Selenium, diatomic	$\text{Se}_2 \rightleftharpoons \text{Se} + \text{Se}$	$2.8 \pm 0.1$	4
Selenium monoxide	$\text{SeO} \rightleftharpoons \text{Se} + \text{O}$	$3.5 \pm 1$	4
Selenium dioxide	$\text{SeO}_2 \rightleftharpoons \text{Se} + 2\text{O}$	$8.72 \pm 0.20$	67
Silicon, diatomic	$\text{Si}_2 \rightleftharpoons \text{Si} + \text{Si}$	3.3	5
Silicon monochloride	$\text{SiCl} \rightleftharpoons \text{Si} + \text{Cl}$	$3.3 \pm 0.5$	4
Silicon monofluoride	$\text{SiF} \rightleftharpoons \text{Si} + \text{F}$	$3.8 \pm 0.4$ 5.42	4 61
Silicon monohydride	$\text{SiH} \rightleftharpoons \text{Si} + \text{H}$	3.2	5
Silicon mononitride	$\text{SiN} \rightleftharpoons \text{Si} + \text{N}$	$4.5 \pm 0.4$	4
Silicon monoxide	$\text{SiO} \rightleftharpoons \text{Si} + \text{O}$	$8.09$ $7.2 \pm 0.4$ $7.33 \pm 0.15$ $8.0 \pm 0.3$	27 4 67 5
Silicon dioxide	$\text{SiO}_2 \rightleftharpoons \text{Si} + 2\text{O}$	$12.96 \pm 0.43$	68
Silicon monosulfide	$\text{SiS} \rightleftharpoons \text{Si} + \text{S}$	$6.4 \pm 0.4$	4
Silver, diatomic	$\text{Ag}_2 \rightleftharpoons \text{Ag} + \text{Ag}$	1.7	5
Silver monochloride	$\text{AgCl} \rightleftharpoons \text{Ag} + \text{Cl}$	$3.3 \pm 0.2$	4
Silver monohydride	$\text{AgH} \rightleftharpoons \text{Ag} + \text{H}$	$2.3 \pm 0.1$	4
Silver monoxide	$\text{AgO} \rightleftharpoons \text{Ag} + \text{O}$	$1.39 \pm 0.40$	67

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Calculated from data in reference.

TABLE I.- BOND DISSOCIATION ENERGY VALUES - Continued

## (a) Inorganic molecules - Continued

Name	Reactions	Energy, ev (a)	Reference
Sodium, diatomic	$\text{Na}_2 \rightleftharpoons \text{Na} + \text{Na}$	0.73	1
Sodium bromide	$\text{NaBr} \rightleftharpoons \text{Na} + \text{Br}$	3.85	1
		$3.84 \pm 0.10$	48
		$3.80 \pm 0.1$	4
	$\text{NaBr} \rightleftharpoons \text{Na}^+ + \text{Br}^-$	5.38	53
Sodium chloride	$\text{NaCl} \rightleftharpoons \text{Na} + \text{Cl}$	$4.23 \pm 0.10$	48
		$4.24 \pm 0.05$	4
	$\text{NaCl} \rightleftharpoons \text{Na}^+ + \text{Cl}^-$	5.64	53
Sodium fluoride	$\text{NaF} \rightleftharpoons \text{Na} + \text{F}$	$5.25 \pm 0.30$	48
		$4.65 \pm 0.25$	4
		4.64	5
	$\text{NaF} \rightleftharpoons \text{Na}^+ + \text{F}^-$	6.55	53
Sodium hydride	$\text{NaH} \rightleftharpoons \text{Na} + \text{H}$	$2.05 \pm 0.2$	4
Sodium hydroxide	$\text{NaOH} \rightleftharpoons \text{Na} + \text{OH}$	3.51	81
Sodium iodide	$\text{NaI} \rightleftharpoons \text{Na} + \text{I}$	3.16	1
		$3.13 \pm 0.10$	48
		$3.07 \pm 0.1$	4
	$\text{NaI} \rightleftharpoons \text{Na}^+ + \text{I}^-$	5.09	53
Sodium nitride	$\text{NaN} \rightleftharpoons \text{Na} + \text{N}$	3.6 to 5.4	98
Sodium monoxide	$\text{NaO} \rightleftharpoons \text{Na} + \text{O}$	3.08	81
Sodium potasside	$\text{NaK} \rightleftharpoons \text{Na} + \text{K}$	$0.62 \pm 0.03$	4
Strontium monofluoride	$\text{SrF} \rightleftharpoons \text{Sr} + \text{F}$	(2.7)	5
Strontium monohydride	$\text{SrH} \rightleftharpoons \text{Sr} + \text{H}$	$1.65 \pm 0.1$	4
Strontium mononitride	$\text{SrN} \rightleftharpoons \text{Sr} + \text{N}$	2.3 to 3.8	98

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Calculated from data in reference.

TABLE I.- BOND DISSOCIATION ENERGY VALUES - Continued

## (a) Inorganic molecules - Continued

Name	Reactions	Energy, ev (a)	Reference
Strontium oxide	$\text{SrO} \rightleftharpoons \text{Sr} + \text{O}$	4.8 $4.6 \pm 0.5$ (3.6)	27 4 5
Sulfur, diatomic	$\text{S}_2 \rightleftharpoons \text{S} + \text{S}$	4.243 $4.4 \pm 0.1$ 3.6	27 4 5
Sulfur hexafluoride	$\text{SF}_6 \rightleftharpoons \text{SF}_5 + \text{F}$	$\leq 3.39$	19
Sulfur nitride	$\text{SN} \rightleftharpoons \text{S} + \text{N}$	$5.0 \pm 1$	13
Sulfur monoxide	$\text{SO} \rightleftharpoons \text{S} + \text{O}$	5.357 5.146 5.184	82 79 4
Sulfur dioxide	$\text{SO}_2 \rightleftharpoons \text{SO} + \text{O}$ $\text{SO}_2 \rightleftharpoons \text{S} + 2\text{O}$	5.68 $11.04 \pm 0.04$	82 68
Sulfur trioxide	$\text{SO}_3 \rightleftharpoons \text{SO}_2 + \frac{1}{2} \text{O}_2$	0.99	79
Tantalum oxide	$\text{TaO} \rightleftharpoons \text{Ta} + \text{O}$	$8.4 \pm 0.5$	5
Tellurium, diatomic	$\text{Te}_2 \rightleftharpoons \text{Te} + \text{Te}$	$2.3 \pm 0.2$	4
Tellurium monoxide	$\text{TeO} \rightleftharpoons \text{Te} + \text{O}$	$2.725 \pm 0.002$	4
Tellurium dioxide	$\text{TeO}_2 \rightleftharpoons \text{Te} + 2\text{O}$	$9.32 \pm 0.33$	67
Tetrafluorohydrazine	$\text{N}_2\text{F}_4 \rightleftharpoons \text{NF}_2 + \text{NF}_2$	0.9	15
Thallium monochloride	$\text{TlCl} \rightleftharpoons \text{Tl} + \text{Cl}$	3.88	69
Thallium monofluoride	$\text{TlF} \rightleftharpoons \text{Tl} + \text{F}$	$4.75 \pm 0.2$	4

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Calculated from data in reference.

TABLE I.- BOND DISSOCIATION ENERGY VALUES - Continued

## (a) Inorganic molecules - Continued

Name	Reactions	Energy, ev (a)	Reference
Thallium monohydride	TlH $\rightleftharpoons$ Tl + H	2.0 $\pm$ 0.2	4
Thallium monoiodide	TlI $\rightleftharpoons$ Tl + I	2.95 $\pm$ 0.12	48
Thorium dioxide	ThO <sub>2</sub> $\rightleftharpoons$ Th + 2O	15.96 $\pm$ 0.60	68
Tin, diatomic	Sn <sub>2</sub> $\rightleftharpoons$ Sn + Sn	1.99	5
Tin monofluoride	SnF $\rightleftharpoons$ Sn + F	3.3 $\pm$ 0.5	4
Tin monoxide	SnO $\rightleftharpoons$ Sn + O	5.72 $\pm$ 0.10	67
Titanium monoxide	TiO $\rightleftharpoons$ Ti + O	6.94 $\pm$ 0.10	67
Titanium dioxide	TiO <sub>2</sub> $\rightleftharpoons$ Ti + 2O	13.57 $\pm$ 0.20	68
Tungsten monoxide	W <sub>2</sub> $\rightleftharpoons$ W + O	6.68 $\pm$ 0.45	58
Tungsten dioxide	W <sub>2</sub> O <sub>3</sub> $\rightleftharpoons$ W + 2O	13.23 $\pm$ 0.43	68
Uranium monoxide	UO $\rightleftharpoons$ U + O	7.76 $\pm$ 0.40	58
Uranium dioxide	UO <sub>2</sub> $\rightleftharpoons$ U + 2O	15.3 $\pm$ 0.6	68
Vanadium monoxide	VO $\rightleftharpoons$ V + O	6.4	5
Vanadium dioxide	VO <sub>2</sub> $\rightleftharpoons$ V + 2O	12.84 $\pm$ 0.43	68
Water	H <sub>2</sub> O $\rightleftharpoons$ H <sub>2</sub> + O	5.01	79
	H <sub>2</sub> O $\rightleftharpoons$ H + OH	5.12	27
		5.10	46
Zinc monochloride	ZnCl $\rightleftharpoons$ Zn + Cl	2.1 $\pm$ 0.2	4
Zinc monohydride	ZnH $\rightleftharpoons$ Zn + H	0.845 $\pm$ 0.02	4

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Calculated from data in reference.

TABLE I.- BOND DISSOCIATION ENERGY VALUES - Continued

## (a) Inorganic molecules - Concluded

Name	Reactions	Energy, ev (a)	Reference
Zinc oxide	$\text{ZnO} \rightleftharpoons \text{Zn} + \text{O}$	$\leq 4.0$	5
Zinc sulfide	$\text{ZnS} \rightleftharpoons \text{Zn} + \text{S}$	4.25	5
Zirconium monoxide	$\text{ZrO} \rightleftharpoons \text{Zr} + \text{O}$	$7.9 \pm 0.2$	13
Zirconium dioxide	$\text{ZrO}_2 \rightleftharpoons \text{Zr} + \text{O}_2$	$9.84 \pm 0.20$	13

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Calculated from data in reference.

TABLE I.- BOND DISSOCIATION ENERGY VALUES - Continued

## (b) Organic molecules

Name	Reaction	Energy, ev (a)	Reference
Acetaldehyde	$\text{CH}_3\text{CHO} \rightleftharpoons \text{CH}_3\text{CO} + \text{H}$ $\text{CH}_3\text{CHO} \rightleftharpoons \text{CH}_3 + \text{CHO}$	3.34 3.26 ± 0.09	70 96
Acetone	$(\text{CH}_3)_2\text{CO} \rightleftharpoons \text{CH}_3\text{CO} + \text{CH}_3$	2.99	70
Acetyl	$\text{CH}_3\text{CO} \rightleftharpoons \text{CH}_3 + \text{CO}$	(0.7)	5
Acetyl bromide	$\text{CH}_3\text{COBr} \rightleftharpoons \text{CH}_3\text{CO} + \text{Br}$	2.56	70
Acetyl chloride	$\text{CH}_3\text{COCl} \rightleftharpoons \text{CH}_3\text{CO} + \text{Cl}$	3.16	70
Acetylene	$\text{C}_2\text{H}_2 \rightleftharpoons \text{C}_2\text{H} + \text{H}$ $\text{C}_2\text{H}_2 \rightleftharpoons \text{CH} + \text{CH}$	(4.9) 9.89	45 45
Benzene	$\text{C}_6\text{H}_6 \rightleftharpoons \text{C}_6\text{H}_5 + \text{H}$	4.42	5
Biacetyl	$\text{CH}_3\text{COCOCH}_3 \rightleftharpoons 2\text{CH}_3\text{CO}$	2.6	96
n-Butane	$\text{n-C}_4\text{H}_{10} \rightleftharpoons \text{n-C}_3\text{H}_7 + \text{CH}_3$ $\text{n-C}_4\text{H}_{10} \rightleftharpoons \text{n-C}_4\text{H}_9 + \text{H}$ $\text{n-C}_4\text{H}_{10} \rightleftharpoons \text{C}_2\text{H}_5 + \text{C}_2\text{H}_5$	3.75 4.39 3.45	49 5 49
iso-Butane	$\text{iso-C}_4\text{H}_{10} \rightleftharpoons \text{iso-C}_3\text{H}_7 + \text{CH}_3$ $\text{iso-C}_4\text{H}_{10} \rightleftharpoons \text{tert-C}_4\text{H}_9 + \text{H}$	(3.84) 3.47 3.87	49 71 5
Carbon tetrabromide	$\text{CBr}_4 \rightleftharpoons \text{CBr}_3 + \text{Br}$	2.16 ± 0.05	85
Carbon monochloride	$\text{CCl} \rightleftharpoons \text{C} + \text{Cl}$	(2.2)	13
Carbon dichloride	$\text{CCl}_2 \rightleftharpoons \text{CCl} + \text{Cl}$	3.45 ± 0.49	85

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Calculated from data in reference.

TABLE I.- BOND DISSOCIATION ENERGY VALUES - Continued

## (b) Organic molecules - Continued

Name	Reaction	Energy, ev (a)	Reference
Carbon trichloride	$\text{CCl}_3 \rightleftharpoons \text{CCl}_2 + \text{Cl}$	2.73 $2.36 \pm 0.22$	5 85
Carbon tetrachloride	$\text{CCl}_4 \rightleftharpoons \text{CCl}_3 + \text{Cl}$	3.30 $\pm 0.07$ 2.95 $\pm 0.13$ 3.12 $\pm 0.12$	21 41 85
Carbon monofluoride	$\text{CF} \rightleftharpoons \text{C} + \text{F}$	4.96 $4.6 \pm 0.3$	13 4
Carbon difluoride	$\text{CF}_2 \rightleftharpoons \text{C} + 2\text{F}$ $\text{CF}_2 \rightleftharpoons \text{CF} + \text{F}$	9.83 $4.48 \pm 0.59$	79 85
Carbon trifluoride	$\text{CF}_3 \rightleftharpoons \text{CF}_2 + \text{F}$	4.94 b4.4 $5.43 \pm 0.29$	79 13 85
Carbon tetrafluoride	$\text{CF}_4 \rightleftharpoons \text{CF}_3 + \text{F}$	5.25 $\pm 0.20$ 5.05	41 79
Ethane	$\text{C}_2\text{H}_6 \rightleftharpoons \text{C}_2\text{H}_5 + \text{H}$ $\text{C}_2\text{H}_6 \rightleftharpoons \text{CH}_3 + \text{CH}_3$	4.21 $3.64 \pm 0.04$	45 45
Ethyl	$\text{C}_2\text{H}_5 \rightleftharpoons \text{C}_2\text{H}_4 + \text{H}$	1.6	45
Ethyl alcohol	$\text{C}_2\text{H}_5\text{OH} \rightleftharpoons \text{C}_2\text{H}_5 + \text{OH}$ $\text{C}_2\text{H}_5\text{OH} \rightleftharpoons \text{C}_2\text{H}_5\text{O} + \text{H}$	3.86 4.29	71 71
Ethyl ether	$(\text{C}_2\text{H}_5)_2\text{O} \rightleftharpoons \text{C}_2\text{H}_5\text{O} + \text{C}_2\text{H}_5$	3.34	71
Ethylene	$\text{C}_2\text{H}_4 \rightleftharpoons \text{C}_2\text{H}_3 + \text{H}$ $\text{C}_2\text{H}_4 \rightleftharpoons \text{CH}_2 + \text{CH}_2$	4.51 (5.29)	45 45
Ethyne	$\text{C}_2\text{H} \rightleftharpoons \text{C}_2 + \text{H}$	(5.7)	45

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Calculated from data in reference.

TABLE I.- BOND DISSOCIATION ENERGY VALUES - Continued

## (b) Organic molecules - Continued

Name	Reaction	Energy, ev (a)	Reference
Formaldehyde	$\text{HCHO} \rightleftharpoons \text{CHO} + \text{H}$	3.3	5
Formyl	$\text{CHO} \rightleftharpoons \text{CO} + \text{H}$	1.2	5
	$\text{CHO} \rightleftharpoons \text{CH} + \text{O}$	b $8.81 \pm 0.12$	13
Glyoxal	$\text{CHOCHO} \rightleftharpoons \text{CHO} + \text{CHO}$	$\leq 2.84$	89
Ketene	$\text{CH}_2\text{CO} \rightleftharpoons \text{CH}_2 + \text{CO}$	(3.5)	5
Methane	$\text{CH}_4 \rightleftharpoons \text{CH}_3 + \text{H}$	4.40	45
Methyl	$\text{CH}_3 \rightleftharpoons \text{CH}_2 + \text{H}$	3.8	5
Methylene	$\text{CH}_2 \rightleftharpoons \text{CH} + \text{H}$	5.4	5
Methylidyne	$\text{CH} \rightleftharpoons \text{C} + \text{H}$	3.47	45
	$\text{CH}^+ \rightleftharpoons \text{C}^+ + \text{H}$	3.6	1
Methyl alcohol	$\text{CH}_3\text{OH} \rightleftharpoons \text{CH}_3\text{O} + \text{H}$	4.34	71
	$\text{CH}_3\text{OH} \rightleftharpoons \text{CH}_3 + \text{OH}$	3.95	50
		3.82	71
Methylamine	$\text{CH}_3\text{NH}_2 \rightleftharpoons \text{CH}_3\text{NH} + \text{H}$	(4.27)	71
	$\text{CH}_3\text{NH}_2 \rightleftharpoons \text{CH}_3 + \text{NH}_2$	3.47	71
Methyl bromide	$\text{CH}_3\text{Br} \rightleftharpoons \text{CH}_3 + \text{Br}$	2.33 2.91	50 5
Methyl chloride	$\text{CH}_3\text{Cl} \rightleftharpoons \text{CH}_3 + \text{Cl}$	3.40	50
Methyl cyanide	$\text{CH}_3\text{CN} \rightleftharpoons \text{CH}_3 + \text{CN}$	4.47	50
Methyl ether	$(\text{CH}_3)_2\text{O} \rightleftharpoons \text{CH}_3\text{O} + \text{CH}_3$	3.34	71

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Calculated from data in reference.

TABLE I.- BOND DISSOCIATION ENERGY VALUES - Continued

## (b) Organic molecules - Continued

Name	Reaction	Energy, ev (a)	Reference
Methyl fluoride	$\text{CH}_3\text{F} \rightleftharpoons \text{CH}_3 + \text{F}$	4.64	5
Methyl iodide	$\text{CH}_3\text{I} \rightleftharpoons \text{CH}_3 + \text{I}$	2.30	5
Methylene bromide	$\text{CH}_2\text{Br}_2 \rightleftharpoons \text{CH}_2\text{Br} + \text{Br}$	$2.59 \pm 0.15$	50
Methylene chloride	$\text{CH}_2\text{Cl}_2 \rightleftharpoons \text{CH}_2\text{Cl} + \text{Cl}$ $\text{CH}_2\text{Cl}_2 \rightleftharpoons \text{CHCl}_2 + \text{H}$	$3.19 \pm 0.12$ $3.46 \pm 0.20$	50
Methyl zinc	$\text{CH}_3\text{Zn} \rightleftharpoons \text{CH}_3 + \text{Zn}$	1.5	5
Monomethyl hydrazine	$\text{CH}_3\text{N}_2\text{H}_3 \rightleftharpoons \text{CH}_3\text{NH} + \text{NH}_2$	2.9	63
Nitromethane	$\text{CH}_3\text{NO}_2 \rightleftharpoons \text{CH}_3 + \text{NO}_2$	(2.3)	5
n-Pentane	$\text{n-C}_5\text{H}_{12} \rightleftharpoons \text{n-C}_4\text{H}_9 + \text{CH}_3$ $\text{n-C}_5\text{H}_{12} \rightleftharpoons \text{n-C}_3\text{H}_7 + \text{C}_2\text{H}_5$	3.95 3.67	49
neo-Pentane	$\text{neo-C}_5\text{H}_{12} \rightleftharpoons \text{neo-C}_5\text{H}_{11} + \text{H}$	4.13	5
Propane	$\text{C}_3\text{H}_8 \rightleftharpoons \text{n-C}_3\text{H}_7 + \text{H}$ $\text{C}_3\text{H}_8 \rightleftharpoons \text{iso-C}_3\text{H}_7 + \text{H}$ $\text{C}_3\text{H}_8 \rightleftharpoons \text{C}_2\text{H}_5 + \text{CH}_3$	4.36 (4.38) 4.08 3.53	49 49 5 71
Propylene	$\text{C}_2\text{H}_3\text{CH}_3 \rightleftharpoons \text{C}_2\text{H}_3 + \text{CH}_3$	4.01	62
Toluene	$\text{C}_6\text{H}_5\text{CH}_3 \rightleftharpoons \text{C}_6\text{H}_5\text{CH}_2 + \text{H}$	$3.36 \pm 0.06$	96
Tribromomethane	$\text{CHBr}_3 \rightleftharpoons \text{CHBr}_2 + \text{Br}$	$2.67 \pm 0.17$	50

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Calculated from data in reference.

TABLE I.- BOND DISSOCIATION ENERGY VALUES - Concluded

## (b) Organic molecules - Concluded

Name	Reaction	Energy, ev (a)	Reference
Trichlorofluoromethane	$\text{CCl}_3\text{F} \rightleftharpoons \text{CCl}_3 + \text{F}$	$4.42 \pm 0.30$	5
Trichloromethane	$\text{CCl}_3\text{H} \rightleftharpoons \text{CCl}_3 + \text{H}$	$3.86 \pm 0.13$	41
Trifluorochloromethane	$\text{CF}_3\text{Cl} \rightleftharpoons \text{CF}_3 + \text{Cl}$	3.60	5
Trifluoromethane	$\text{CF}_3\text{H} \rightleftharpoons \text{CF}_3 + \text{H}$	$4.47 \pm 0.20$	41
Vinyl	$\text{C}_2\text{H}_3 \rightleftharpoons \text{C}_2\text{H}_2 + \text{H}$	1.69 $1.8 \pm 0.1$	45 62

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Calculated from data in reference.

TABLE II.- IONIZATION POTENTIAL VALUES

## (a) Atoms

Name	Symbol	First ionization potential, ev	Reference	Second ionization potential, ev	Reference
Actinium	Ac	6.89	6	11.5	6
Aluminum	Al	5.984	78	18.823	78
Antimony	Sb	8.639	78	16.7	6
Argon	Ar	15.755	78	27.62	78
Arsenic	As	9.81	78	20.2	78
Astatine	At	9.2	6	20.1	6
Barium	Ba	5.210	78	10.001	78
Beryllium	Be	9.320	78	18.206	78
Bismuth	Bi	7.287	78	19.3	78
Boron	B	8.296	78	25.149	78
Bromine	Br	11.84	78	21.6	78
Cadmium	Cd	8.991	78	16.904	78
Calcium	Ca	6.111	78	11.87	78
Carbon	C	11.264	78	24.376	78
Cerium	Ce	6.91	6	12.3	6
Cesium	Cs	3.893	78	25.1	78
Chlorine	Cl	13.01	78	23.80	78
Chromium	Cr	6.764	78	16.49	78
Cobalt	Co	7.86	78	17.05	78
Copper	Cu	7.724	78	20.29	78
Europium	Eu	5.67	78	11.24	78
Fluorine	F	17.418	78	34.98	78
Francium	Fr	3.98	6	22.5	6
Gallium	Ga	6.00	78	20.51	78
Germanium	Ge	7.88	78	15.93	78
Gold	Au	9.22	78	20.5	78
Hafnium	Hf	5.5	78	14.9	78
Helium	He	24.580	78	54.403	78
Hydrogen	H	13.595	78	-----	78
Indium	In	5.785	78	18.828	78
Iodine	I	10.44	78	19.0	78
Iridium	Ir	9.2	78	17.0	6
Iron	Fe	7.90	78	16.18	78
Krypton	Kr	13.996	78	24.56	78
Lanthanum	La	5.61	78	11.43	78
Lead	Pb	7.415	78	15.028	78
Lithium	Li	5.390	78	75.619	78
Lutetium	Lu	6.15	6	14.7	6
Magnesium	Mg	7.644	78	15.03	78
Manganese	Mn	7.432	78	15.64	78
Mercury	Hg	10.434	78	18.751	78

TABLE II.- IONIZATION POTENTIAL VALUES - Continued

## (a) Atoms - Concluded

Name	Symbol	First ionization potential, ev	Reference	Second ionization potential, ev	Reference
Molybdenum	Mo	7.131	78	15.72	78
Neon	Ne	21.559	78	41.07	78
Nickel	Ni	7.633	78	18.15	78
Niobium	Nb	6.881	78	13.895	78
Nitrogen	N	14.54	78	29.605	78
Osmium	Os	8.7	78	17	6
Oxygen	O	13.614	78	35.146	78
Palladium	Pd	8.33	78	19.42	78
Phosphorus	P	10.55	78	19.65	78
Platinum	Pt	9.0	78	18.56	78
Polonium	Po	8.43	78	19.4	6
Potassium	K	4.339	78	31.81	78
Radium	Ra	5.277	78	10.14	78
Radon	Rn	10.745	78	21.4	6
Rhenium	Re	7.87	78	16.6	6
Rhodium	Rh	7.461	78	15.92	78
Rubidium	Rb	4.176	78	27.5	78
Ruthenium	Ru	7.365	78	16.597	78
Samarium	Sm	5.6	78	11.2	78
Scandium	Sc	6.56	78	12.80	78
Selenium	Se	9.75	78	21.5	78
Silicon	Si	8.149	78	16.34	78
Silver	Ag	7.574	78	21.48	78
Sodium	Na	5.138	78	47.29	78
Strontium	Sr	5.692	78	11.027	78
Sulfur	S	10.357	78	23.4	78
Tantalum	Ta	7.7	78	16.2	6
Technetium	Tc	7.23	78	14.87	78
Tellurium	Te	9.01	78	18.8	6
Thallium	Tl	6.106	78	20.42	78
Thorium	Th			11.5	6
Tin	Sn	7.332	78	14.63	78
Titanium	Ti	6.83	78	13.57	78
Tungsten	W	7.98	78	17.7	6
Uranium	U	4	78		
Vanadium	V	6.74	78	14.65	78
Xenon	Xe	12.127	78	21.21	78
Yttrium	Y	6.377	78	12.233	78
Zinc	Zn	9.391	78	17.96	78
Zirconium	Zr	6.835	78	12.916	78

TABLE II.- IONIZATION POTENTIAL VALUES - Continued

## (b) Inorganic molecules

Name	Formula	Energy, ev (a)	Reference
Aluminum monoxide	AlO	b <sub>9.5</sub> ± 0.5	30
Aluminum monoxide, dimer	Al <sub>2</sub> O <sub>2</sub>	b <sub>9.9</sub> ± 0.5	30
Aluminum suboxide	Al <sub>2</sub> O	b <sub>7.7</sub> ± 0.5	30
Amidogen	NH <sub>2</sub>	b <sub>11.3</sub> b <sub>11.4</sub> ± 0.1	9 42
Ammonia	NH <sub>3</sub>	b <sub>10.52</sub> c <sub>10.15</sub> ± 0.01	9 10
Antimony monochloride	SbCl	b <sub>10.9</sub>	9
Beryllium monoxide	BeO	10.4 ± 0.2	66
Boron, diatomic	B <sub>2</sub>	b <sub>12.06</sub>	44
Boron dibromide	BBR <sub>2</sub>	b(7.0)	64
Boron tribromide	BBR <sub>3</sub>	b <sub>9.7</sub> ± 0.2	64
Boron monochloride	BCl	b(10.44)	64
Boron dichloride	BCl <sub>2</sub>	b <sub>≤9</sub> b(7.20)	60 64
Boron trichloride	BCl <sub>3</sub>	b <sub>12.0</sub> ± 0.5 b <sub>10.9</sub> ± 0.2	9 64
Boron difluoride	BF <sub>2</sub>	b <sub>≤10</sub>	60
Boron trifluoride	BF <sub>3</sub>	b <sub>15.7</sub> ± 0.1	60
Boron monohydride	BH	b <sub>≤10.06</sub>	44

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Electron impact technique.<sup>c</sup>Photoionization technique.<sup>d</sup>Spectroscopic technique.

TABLE II.- IONIZATION POTENTIAL VALUES - Continued

## (b) Inorganic molecules - Continued

Name	Formula	Energy, ev (a)	Reference
Boron dihydride	$\text{BH}_2$	$b \leq 8.12$	44
Boron trihydride	$\text{BH}_3$	$b \leq 11$ to 12	44
Boron monoiodide	BI	$b(8.96)$	64
Boron diodide	BI <sub>2</sub>	$b(7.13)$	64
Boron triiodide	BI <sub>3</sub>	$b9.0 \pm 0.2$	64
Boron monoxide	BO	(12.8)	66
Boric oxide	B <sub>2</sub> O <sub>3</sub>	$b(13.3)$	105
Bromine	Br <sub>2</sub>	$c10.55 \pm 0.02$ $b10.58 \pm 0.08$ $b10.92$	10 23 9
Carbon, diatomic	C <sub>2</sub>	$b12.0 \pm 0.6$ $b11.5 \pm 0.1$	33 9
Carbon, triatomic	C <sub>3</sub>	$b12.6 \pm 0.6$	33
Carbon, tetratomic	C <sub>4</sub>	$b12.6$	33
Carbon, pentatomic	C <sub>5</sub>	$b12.5 \pm 1$	33
Carbon monoxide	CO	$c14.01 \pm 0.01$ $d14.013$ $b14.1$	10 10 9

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Electron impact technique.<sup>c</sup>Photoionization technique.<sup>d</sup>Spectroscopic technique.

TABLE II.- IONIZATION POTENTIAL VALUES - Continued

## (b) Inorganic molecules - Continued

Name	Formula	Energy, ev (a)	Reference
Carbon dioxide	CO <sub>2</sub>	b13.85 c13.79 ± 0.01 d13.79	9 10 10
Carbon oxysulfide	COS	c11.17 ± 0.01	77
Carbon monosulfide	CS	b10.7 ± 0.3 11.9 ± 0.3	9 113
Carbon disulfide	CS <sub>2</sub>	b10.13 ± 0.02 c10.08 ± 0.01 d10.079	9 10 10
Chlorine	Cl <sub>2</sub>	b11.80 c11.48 ± 0.01 b11.64 ± 0.05	9 10 23
Chlorine monoxide	ClO	b≤10.4	52
Chlorine dioxide	ClO <sub>2</sub>	b≤11.1	52
Chlorine trioxide	ClO <sub>3</sub>	b≤11.7	52
Cyano	CN	b14.6 b14.5 ± 0.5 b14.55 or 13.42 b14.0 14.2 ± 0.3	38 37 39 9 86
Cyanoacetylene	HC <sub>3</sub> N	b11.6 ± 0.2	37

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Electron impact technique.<sup>c</sup>Photoionization technique.<sup>d</sup>Spectroscopic technique.

TABLE II.- IONIZATION POTENTIAL VALUES - Continued

## (b) Inorganic molecules - Continued

Name	Formula	Energy, ev (a)	Reference
Cyanogen	$\text{C}_2\text{N}_2$	$b13.6 \pm 0.2$ $b13.57 \pm 0.02$ $d13.8$	37 38 10
-----	$\text{C}_2\text{N}$	$b12.8$	37
Cyanogen bromide	$\text{CNBr}$	$b11.95 \pm 0.08$	38
Cyanogen chloride	$\text{CNCl}$	$b12.49 \pm 0.04$	38
Cyanogen iodide	$\text{CNI}$	$b10.98 \pm 0.05$	38
Decaborane	$\text{B}_{10}\text{H}_{14}$	$b11.0 \pm 0.5$	59
Dibarium monoxide	$\text{Ba}_2\text{O}$	$b(4.0)$	109
Diborane	$\text{B}_2\text{H}_6$	$b11.9 \pm 0.1$	44
Diboron monohydride	$\text{B}_2\text{H}$	$b(10.62)$	44
Diboron dihydride	$\text{B}_2\text{H}_2$	$b(11.36)$	44
Diboron trihydride	$\text{B}_2\text{H}_3$	$b(8.79)$	44
Diboron tetrahydride	$\text{B}_2\text{H}_4$	$b(10.93)$	44
Diboron pentahydride	$\text{B}_2\text{H}_5$	$b7.86$	44
Diboron dioxide	$\text{B}_2\text{O}_2$	$b(13.3)$	105
Dicyanoacetylene	$\text{C}_4\text{N}_2$	$b11.4 \pm 0.2$	37
-----	$\text{C}_4\text{N}$	$b12.3$	37

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Electron impact technique.<sup>c</sup>Photoionization technique.<sup>d</sup>Spectroscopic technique.

TABLE II.- IONIZATION POTENTIAL VALUES - Continued

## (b) Inorganic molecules - Continued

Name	Formula	Energy, ev (a)	Reference
Dicyanodiacetylene	C <sub>6</sub> N <sub>2</sub>	b11.4 ± 0.2	37
Difluoroamino	NF <sub>2</sub>	11.8 b12.0 ± 0.1	15 84
Difluorodiazine (trans)	trans N <sub>2</sub> F <sub>2</sub>	b13.1 ± 0.1	84
Diimide	N <sub>2</sub> H <sub>2</sub>	b9.85 ± 0.1	42
Disilicon dioxide	Si <sub>2</sub> O <sub>2</sub>	b10 ± 1.0	9
Fluorine	F <sub>2</sub>	d15.7 b16.6 ± 0.2 b15.83 ± 0.05	10 32 23
Hydrazine	N <sub>2</sub> H <sub>4</sub>	b9.00 ± 0.1	63
Hydrazyl	N <sub>2</sub> H <sub>3</sub>	b7.88 ± 0.2	42
Hydrogen	H <sub>2</sub>	b15.44 d15.427 c15.4	9 9 9
Hydrogen bromide	HBr	c11.62 ± 0.01 b11.69	10 9
Hydrogen chloride	HCl	d12.90 c12.74 ± 0.01 b12.8 ± 0.1	9 10 32

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Electron impact technique.<sup>c</sup>Photoionization technique.<sup>d</sup>Spectroscopic technique.

TABLE II.- IONIZATION POTENTIAL VALUES - Continued

## (b) Inorganic molecules - Continued

Name	Formula	Energy, ev (a)	Reference
Hydrogen cyanide	HCN	b13.86	9
Hydrogen fluoride	HF	b16.38 ± 0.05 b16.0 ± 0.2 b15.77	9 32 10
Hydrogen iodide	HI	c10.38 ± 0.02 d10.39 b10.37	10 9 9
Hydrogen peroxide	H <sub>2</sub> O <sub>2</sub>	b11.26 ± 0.05 b12.1 ± 0.3	31 9
Hydrogen persulfide	H <sub>2</sub> S <sub>2</sub>	b10.2	100
Hydroperoxy	HO <sub>2</sub>	b11.53 ± 0.1	40
Hydrogen sulfide	H <sub>2</sub> S	b10.5 c10.46 ± 0.01 d10.47	9 10 10
Hydroxyl	OH	b13.53 ± 0.08 b13.49 ± 0.08 b13.18	31 46 10
Imidogen	NH	b≤16.4	94
Iodine	I <sub>2</sub>	b9.41 c9.28 ± 0.02	9 10
Lanthanum monoxide	LaO	b4.8 ± 0.5	106

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Electron impact technique.<sup>c</sup>Photoionization technique.<sup>d</sup>Spectroscopic technique.

TABLE II.- IONIZATION POTENTIAL VALUES - Continued

## (b) Inorganic molecules - Continued

Name	Formula	Energy, ev (a)	Reference
Lithium iodide	LiI	b8.55 ± 0.15	9
Lithium monoxide	LiO	9.0 ± 0.5	66
Molybdenum monoxide	MoO	b8.0 ± 0.6	58
Molybdenum dioxide	MoO <sub>2</sub>	b9.4 ± 0.6	58
Nitric oxide	NO	c9.25 ± 0.02 d9.24 b9.4 ± 0.2	10 10 9
Nitrogen	N <sub>2</sub>	b15.60 ± 0.01 d15.580	9 10
Nitrogen monofluoride	NF	b≤12.4 ± 0.3	84
Nitrogen trifluoride	NF <sub>3</sub>	c12.91 b13.2 ± 0.2	56 108
Nitrogen dioxide	NO <sub>2</sub>	b10.0 c9.78 ± 0.05 d12.3	9 10 10
Nitrous oxide	N <sub>2</sub> O	c12.90 ± 0.01 b12.9 ± 0.5 d12.94	10 9 10
Oxygen	O <sub>2</sub>	c12.075 ± 0.01 d12.2 ± 0.2 b12.1 ± 0.2	10 10 9

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Electron impact technique.<sup>c</sup>Photoionization technique.<sup>d</sup>Spectroscopic technique.

TABLE II.- IONIZATION POTENTIAL VALUES - Continued

## (b) Inorganic molecules - Continued

Name	Formula	Energy, ev (a)	Reference
Oxygen fluoride	OF	b <sub>13.0</sub> ± 0.2	43
Oxygen bifluoride	OF <sub>2</sub>	b <sub>13.7</sub> ± 0.2	43
Ozone	O <sub>3</sub>	b <sub>12.80</sub>	10
Pentaborane	B <sub>5</sub> H <sub>9</sub>	b <sub>10.8</sub> ± 0.5	59
Perchlorylfluoride	ClO <sub>3</sub> F	b(13.6)	52
Phosphorus trichloride	PCl <sub>3</sub>	b <sub>12.3</sub>	9
Phosphorus trihydride	PH <sub>3</sub>	b <sub>10.0</sub>	9
Potassium iodide	KI	b <sub>8.3</sub> ± 0.2	9
Selenium dihydride	SeH <sub>2</sub>	d <sub>9.88</sub>	10
Silicon tetrachloride	SiCl <sub>4</sub>	b <sub>11.6</sub> ± 0.2	9
Silicon monofluoride	SiF	d <sub>7.26</sub>	61
Silicon tetrafluoride	SiF <sub>4</sub>	b <sub>15.4</sub> ± 0.4	57
Silicon tetrahydride	SiH <sub>4</sub>	b <sub>12.2</sub> ± 0.3	9
Silicon monoxide	SiO	b <sub>10.8</sub> ± 0.5	9
Silicon dioxide	SiO <sub>2</sub>	b <sub>11.7</sub> ± 0.5	9
Sodium hydroxide	NaOH	b(9.0)	103

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Electron impact technique.<sup>c</sup>Photoionization technique.<sup>d</sup>Spectroscopic technique.

TABLE II.- IONIZATION POTENTIAL VALUES - Continued

## (b) Inorganic molecules - Continued

Name	Formula	Energy, ev (a)	Reference
Sodium iodide	NaI	b8.8 ± 0.3	9
Sulfur, diatomic	S <sub>2</sub>	b10.8 ± 0.3 10.3 ± 0.2	9 113
Sulfur pentafluoride	SF <sub>5</sub>	b≤12.7	60
Sulfur hexafluoride	SF <sub>6</sub>	19.3 20.1	72 110
Sulfur monohydride	SH	b11.1	9
Sulfur monoxide	SO	b≤11.0 12.1 ± 0.3	92 113
Sulfur dioxide	SO <sub>2</sub>	b13.4 ± 0.3 c12.34 ± 0.02 d12.05	9 10 9
Sulfuryl fluoride	SO <sub>2</sub> F <sub>2</sub>	b13.3 ± 0.1	92
Tellurium dihydride	TeH <sub>2</sub>	d9.14	10
Tetrafluorohydrazine	N <sub>2</sub> F <sub>4</sub>	b12.04 ± 0.10	57
Titanium tetrachloride	TiCl <sub>4</sub>	b11.7 ± 0.2	9
Triazene	N <sub>3</sub> H <sub>3</sub>	b9.6 ± 0.1	42
Tungsten monoxide	WO	b9.1 ± 1	58
Tungsten dioxide	WO <sub>2</sub>	b9.9 ± 0.6	58

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Electron impact technique.<sup>c</sup>Photoionization technique.<sup>d</sup>Spectroscopic technique.

TABLE II.- IONIZATION POTENTIAL VALUES - Continued

## (b) Inorganic molecules - Concluded

Name	Formula	Energy, ev (a)	Reference
Uranium tetrachloride	UCl <sub>4</sub>	b11.5	9
Uranium hexafluoride	UF <sub>6</sub>	15.5	72
Uranium monoxide	UO	b4.7 ± 0.6	58
Uranium dioxide	UO <sub>2</sub>	b4.3 ± 0.6	58
Water	H <sub>2</sub> O	b12.69 ± 0.08 c12.59 ± 0.01 b12.67 d12.61	31 10 9 10
Zirconium monoxide	ZrO	b(5.5)	107
Zirconium dioxide	ZrO <sub>2</sub>	8 ± 0.5	107

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Electron impact technique.<sup>c</sup>Photoionization technique.<sup>d</sup>Spectroscopic technique.

TABLE II.- IONIZATION POTENTIAL VALUES - Continued

## (c) Organic molecules

Name	Formula	Energy, ev (a)	Reference
Acetaldehyde	CH <sub>3</sub> CHO	c10.21 ± 0.01	10
Acetic acid	CH <sub>3</sub> CO <sub>2</sub> H	c10.37 ± 0.03	10
Acetone	(CH <sub>3</sub> ) <sub>2</sub> CO	c9.69 ± 0.01	10
Acetyl	CH <sub>3</sub> CO	b7.92 b8.08 ± 0.09	9 89
Acetylene	C <sub>2</sub> H <sub>2</sub>	b11.42 c11.41 ± 0.01 d11.41	9 10 10
Acetyl chloride	CH <sub>3</sub> COCl	c11.02 ± 0.05	10
Allyl	C <sub>3</sub> H <sub>5</sub>	b8.16	9
Aniline	C <sub>6</sub> H <sub>5</sub> NH <sub>2</sub>	c7.70 ± 0.02	10
Benzene	C <sub>6</sub> H <sub>6</sub>	c9.245 ± 0.01	10
Benzonitrile	C <sub>6</sub> H <sub>5</sub> CN	c9.705 ± 0.005	10
Benzyl	C <sub>6</sub> H <sub>5</sub> CH <sub>2</sub>	b7.73	9
Bromomethyl	CH <sub>2</sub> Br	b8.34 ± 0.11	50
n-Butane	n-C <sub>4</sub> H <sub>10</sub>	c10.63 ± 0.05	10
iso-Butane	iso-C <sub>4</sub> H <sub>10</sub>	c10.57	10

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Electron impact technique.<sup>c</sup>Photoionization technique.<sup>d</sup>Spectroscopic technique.

TABLE II.- IONIZATION POTENTIAL VALUES - Continued

## (c) Organic molecules - Continued

Name	Formula	Energy, ev (a)	Reference
1-Butene	1-C <sub>4</sub> H <sub>8</sub>	c9.58 ± 0.01	10
n-Butyl	n-C <sub>4</sub> H <sub>9</sub>	b8.64 ± 0.05	51
iso-Butyl	iso-C <sub>4</sub> H <sub>9</sub>	b8.35 ± 0.05	51
sec-Butyl	sec-C <sub>4</sub> H <sub>9</sub>	b7.93 ± 0.05	51
tert-Butyl	tert-C <sub>4</sub> H <sub>9</sub>	b7.42 ± 0.05 b6.90 ± 0.1	51 9
1-Butyne	C <sub>4</sub> H <sub>6</sub>	c10.18 ± 0.01	10
Carbon monobromide	CBr	b10.43 ± 0.02	85
Carbon dibromide	CBr <sub>2</sub>	b10.11 ± 0.09	85
Carbon monochloride	CCl	b12.9 ± 0.10	85
Carbon dichloride	CCl <sub>2</sub>	b13.10 ± 0.08	85
Carbon dichlorofluoride	CCl <sub>2</sub> F	b<8.69 ± 0.15	29
Carbon trichloride	CCl <sub>3</sub>	b8.78 ± 0.05 b≥7.92 ± 0.35	41 29
Carbon tetrachloride	CCl <sub>4</sub>	c11.47 ± 0.01	10
Carbon monofluoride	CF	b13.81 ± 0.12	85
Carbon difluoride	CF <sub>2</sub>	b13.30 ± 0.12	85

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Electron impact technique.<sup>c</sup>Photoionization technique.<sup>d</sup>Spectroscopic technique.

TABLE II.- IONIZATION POTENTIAL VALUES - Continued

## (c) Organic molecules - Continued

Name	Formula	Energy, ev (a)	Reference
Carbon trifluoride	CF <sub>3</sub>	<sup>b</sup> 8.9 <sup>b</sup> 10.10 ± 0.05	9 41
Carbon tetrafluoride	CF <sub>4</sub>	17.8	72
Carbon monoiodide	CI	<sup>b</sup> ≤10.8	38
Carbonyl chloride	COCl <sub>2</sub>	<sup>b</sup> 11.77	9
Chlorobenzene	C <sub>6</sub> H <sub>5</sub> Cl	<sup>c</sup> 9.07 ± 0.02	10
Chloromethyl	CH <sub>2</sub> Cl	<sup>b</sup> 9.70 ± 0.09	50
Cyanomethyl	CH <sub>2</sub> CN	<sup>b</sup> 9.87	60
Cyclobutane	C <sub>4</sub> H <sub>8</sub>	<sup>b</sup> 10.58	65
Cyclobutyl	C <sub>4</sub> H <sub>7</sub>	<sup>b</sup> 7.88 ± 0.05	65
Cyclohexane	C <sub>6</sub> H <sub>12</sub>	<sup>c</sup> 9.88 ± 0.02	10
Cyclohexene	C <sub>6</sub> H <sub>10</sub>	<sup>c</sup> 8.945 ± 0.01	10
Cyclohexyl	C <sub>6</sub> H <sub>11</sub>	<sup>b</sup> 7.66 ± 0.05	65
Cyclopentane	C <sub>5</sub> H <sub>10</sub>	<sup>c</sup> 10.53 ± 0.05	10
Cyclopentyl	C <sub>5</sub> H <sub>9</sub>	<sup>b</sup> 7.79 ± 0.03	65
Cyclopropane	C <sub>3</sub> H <sub>6</sub>	<sup>c</sup> 10.06 ± 0.03	10

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Electron impact technique.<sup>c</sup>Photoionization technique.<sup>d</sup>Spectroscopic technique.

TABLE II.- IONIZATION POTENTIAL VALUES - Continued

## (c) Organic molecules - Continued

Name	Formula	Energy, ev (a)	Reference
Cyclopropyl	C <sub>3</sub> H <sub>5</sub>	b8.05 ± 0.1	65
Dibromomethyl	CHBr <sub>2</sub>	b8.13 ± 0.16	50
Dichloromethyl	CHCl <sub>2</sub>	b9.54 ± 0.10	50
Diethyl amine	(C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub> NH	c8.01	10
Diethyl ether	(C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub> O	c9.53 ± 0.03	10
Diethyl sulfide	(C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub> S	c8.430 ± 0.005	10
Difluorobromomethane	CHBrF <sub>2</sub>	b12.1 ± 0.2	9
Difluorodibromomethane	CF <sub>2</sub> Br <sub>2</sub>	c11.07 ± 0.03	10
Difluorodichloroethylene	C <sub>2</sub> F <sub>2</sub> Cl <sub>2</sub>	b10.0 ± 0.2	83
Dimethyl borane	B(CH <sub>3</sub> ) <sub>2</sub>	b(6.44)	64
Dimethoxy borane	HB(OCH <sub>3</sub> ) <sub>2</sub>	b9.7 ± 1.0	10 <sup>4</sup>
Ethane	C <sub>2</sub> H <sub>6</sub>	c11.65 ± 0.03	10
Ethyl	C <sub>2</sub> H <sub>5</sub>	b8.72 c≤8.4	9 93
Ethyl alcohol	C <sub>2</sub> H <sub>5</sub> OH	c10.48 ± 0.05	10
Ethyl amine	C <sub>2</sub> H <sub>5</sub> NH <sub>2</sub>	c8.86 b9.32	10 9

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Electron impact technique.<sup>c</sup>Photoionization technique.<sup>d</sup>Spectroscopic technique.

TABLE II.- IONIZATION POTENTIAL VALUES - Continued

## (c) Organic molecules - Continued

Name	Formula	Energy, ev (a)	Reference
Ethylene	C <sub>2</sub> H <sub>4</sub>	<sup>b</sup> 10.56 <sup>c</sup> 10.515 ± 0.01 <sup>d</sup> 10.51	9 10 10
Ethylene oxide	(CH <sub>2</sub> ) <sub>2</sub> O	<sup>c</sup> 10.565 ± 0.01	10
Ethyldecaborane	C <sub>2</sub> H <sub>5</sub> B <sub>10</sub> H <sub>13</sub>	<sup>b</sup> 9.0 ± 0.5	59
Ethyne	C <sub>2</sub> H	11.3	111
Formaldehyde	HCHO	<sup>c</sup> 10.87 ± 0.01	10
Formamide	HCONH <sub>2</sub>	<sup>c</sup> 10.25 ± 0.02	10
Formic acid	H <sub>2</sub> CO <sub>2</sub>	<sup>c</sup> 11.05 ± 0.01	10
Formyl	CHO	<sup>b</sup> (8.8) <sup>b</sup> (10.0) <sup>b</sup> 9.88 ± 0.05	9 9 89
Freon 11	CFCl <sub>3</sub>	<sup>c</sup> 11.77 ± 0.02	10
Freon 12	CF <sub>2</sub> Cl <sub>2</sub>	<sup>c</sup> 12.31 ± 0.05	10
Freon 13	CClF <sub>3</sub>	<sup>c</sup> 12.91 ± 0.03	10
Freon 22	CHClF <sub>2</sub>	<sup>c</sup> 12.45 ± 0.05	10
Freon 113	CF <sub>3</sub> CCl <sub>3</sub>	<sup>c</sup> 11.78 ± 0.03	10
Genetron 101	CH <sub>3</sub> CF <sub>2</sub> Cl	<sup>c</sup> 11.98 ± 0.01	10

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Electron impact technique.<sup>c</sup>Photoionization technique.<sup>d</sup>Spectroscopic technique.

TABLE II.- IONIZATION POTENTIAL VALUES - Continued

## (c) Organic molecules - Continued

Name	Formula	Energy, ev (a)	Reference
n-Heptane	n-C <sub>7</sub> H <sub>16</sub>	c10.08	10
n-Hexane	n-C <sub>6</sub> H <sub>14</sub>	c10.18	10
Methane	CH <sub>4</sub>	c12.98 ± 0.01 b13.12	10 9
Methanethiol	CH <sub>3</sub> SH	c9.440 ± 0.005	10
Methyl	CH <sub>3</sub>	d9.840 b9.96 c9.82 ± 0.04 d9.843	10 9 93 112
Methyl acetate	CH <sub>3</sub> CO <sub>2</sub> CH <sub>3</sub>	c10.27 ± 0.02	10
Methyl alcohol	CH <sub>3</sub> OH	c10.85 ± 0.02	10
Methyl amine	CH <sub>3</sub> NH <sub>2</sub>	c8.97	10
Methyl borane	B(CH <sub>3</sub> )	b(9.28)	64
Methyl bromide	CH <sub>3</sub> Br	c10.53 ± 0.01	10
Methyl chloride	CH <sub>3</sub> Cl	c11.28 ± 0.01	10
Methyl cyanide	CH <sub>3</sub> CN	c12.23 ± 0.01 b12.46	10 9
Methyl fluoride	CH <sub>3</sub> F	b12.72	9

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Electron impact technique.<sup>c</sup>Photoionization technique.<sup>d</sup>Spectroscopic technique.

TABLE II.- IONIZATION POTENTIAL VALUES - Continued

## (c) Organic molecules - Continued

Name	Formula	Energy, ev (a)	Reference
Methyl iodide	CH <sub>3</sub> I	c9.54 ± 0.01	10
Methyl sulfide	CH <sub>3</sub> S	b8.2	9
Methyl thiocyanate	CH <sub>3</sub> SCN	c10.065 ± 0.01	10
Methylene	CH <sub>2</sub>	b11.9 d10.396 ± 0.003	9 112
Methylene bromide	CH <sub>2</sub> Br <sub>2</sub>	c10.49 ± 0.02	10
Methylene chloride	CH <sub>2</sub> Cl <sub>2</sub>	c11.35 ± 0.02	10
Methyldyne	CH	d11.13	9
Monomethyl hydrazine	CH <sub>3</sub> N <sub>2</sub> H <sub>3</sub>	b8.63 ± 0.1	63
Nitromethane	CH <sub>3</sub> NO <sub>2</sub>	c11.08 ± 0.03	10
n-Octane	n-C <sub>8</sub> H <sub>18</sub>	b10.24	9
n-Pentane	n-C <sub>5</sub> H <sub>12</sub>	c10.35	10
iso-Pentane	iso-C <sub>5</sub> H <sub>12</sub>	c10.32	10
neo-Pentane	neo-C <sub>5</sub> H <sub>12</sub>	c10.35	10
2-Pentyl	2-C <sub>5</sub> H <sub>11</sub>	b7.73	87
3-Pentyl	3-C <sub>5</sub> H <sub>11</sub>	b7.86	87

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Electron impact technique.<sup>c</sup>Photoionization technique.<sup>d</sup>Spectroscopic technique.

TABLE II.- IONIZATION POTENTIAL VALUES - Continued

## (c) Organic molecules - Continued

Name	Formula	Energy, ev (a)	Reference
neo-Pentyl	neo-C <sub>5</sub> H <sub>11</sub>	b8.33	87
tert-Pentyl	tert-C <sub>5</sub> H <sub>11</sub>	b7.12	87
Phenol	C <sub>6</sub> H <sub>5</sub> OH	c8.50 ± 0.01	10
Phenyl	C <sub>6</sub> H <sub>5</sub>	b9.89	9
Propane	C <sub>3</sub> H <sub>8</sub>	c11.07 ± 0.05	10
Propargyl	C <sub>3</sub> H <sub>3</sub>	b8.25 ± 0.08	9
n-Propyl	n-C <sub>3</sub> H <sub>7</sub>	b8.69 ± 0.05 c7.45 b8.4 c≤8.1	51 49 9 93
iso-Propyl	iso-C <sub>3</sub> H <sub>7</sub>	b7.90 ± 0.05 c7.20 c≤7.5	51 49 93
Propylene	C <sub>3</sub> H <sub>6</sub>	c9.73 ± 0.01	10
Propyne	C <sub>3</sub> H <sub>4</sub>	c10.36 ± 0.01	10
Tetrachloroethylene	C <sub>2</sub> Cl <sub>4</sub>	c9.32 ± 0.01	10
Tetrafluoroethylene	C <sub>2</sub> F <sub>4</sub>	b9.3 ± 0.2	83

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Electron impact technique.<sup>c</sup>Photoionization technique.<sup>d</sup>Spectroscopic technique.

TABLE II.- IONIZATION POTENTIAL VALUES - Concluded

## (c) Organic molecules - Concluded

Name	Formula	Energy, ev (a)	Reference
Toluene	C <sub>6</sub> H <sub>5</sub> CH <sub>3</sub>	<sup>c</sup> 8.82 ± 0.01	10
Trichloromethane	CCl <sub>3</sub> H	<sup>c</sup> 11.42 ± 0.03	10
Triethyl amine	(C <sub>2</sub> H <sub>5</sub> ) <sub>3</sub> N	<sup>c</sup> 7.50 <sup>b</sup> 9.1 ± 0.2	10 9
Triethyl borane	B(C <sub>2</sub> H <sub>5</sub> ) <sub>3</sub>	<sup>b</sup> 9.0 ± 0.2	10 <sup>4</sup>
Trifluorochloroethylene	C <sub>2</sub> F <sub>3</sub> Cl	<sup>b</sup> 10.4 ± 0.2	83
Trifluoroiodoethane	CF <sub>3</sub> CH <sub>2</sub> I	<sup>c</sup> 10.00 ± 0.01	10
Trimethoxy borane	B(OCH <sub>3</sub> ) <sub>3</sub>	<sup>b</sup> 8.9 ± 0.2	10 <sup>4</sup>
Trimethyl borane	B(CH <sub>3</sub> ) <sub>3</sub>	<sup>b</sup> 8.8 ± 0.2	10 <sup>4</sup>
Vinyl	C <sub>2</sub> H <sub>3</sub>	<sup>b</sup> 9.45 ± 0.05	62
Vinyl chloride	CH <sub>2</sub> CHCl	<sup>c</sup> 9.995 ± 0.01	10
p-Xylene	C <sub>6</sub> H <sub>4</sub> (CH <sub>3</sub> ) <sub>2</sub>	<sup>c</sup> 8.445 ± 0.01	10
p-Xylyl	CH <sub>3</sub> C <sub>6</sub> H <sub>4</sub> CH <sub>2</sub>	<sup>b</sup> 7.46 ± 0.03	9

<sup>a</sup>Approximate values shown in parentheses.<sup>b</sup>Electron impact technique.<sup>c</sup>Photoionization technique.<sup>d</sup>Spectroscopic technique.

TABLE III.- ELECTRON AFFINITY VALUES

Name	Formula	Energy, ev (a)	Reference
Aluminum	Al	0.52	18
Amidogen	NH <sub>2</sub>	1.2 ± 0.4	95
Boron	B	0.33	18
Boron trifluoride	BF <sub>3</sub>	2.17	12
Bromine	Br	3.53 ± 0.12 3.49 ± 0.05 3.54 ± 0.06 3.51 ± 0.06	22 80 12 97
Carbon	C	1.24 1.12 ± 0.05 1.25 ± 0.03	18 24 76
Carbon, diatomic	C <sub>2</sub>	3.1 or 4.0	47
Carbon, triatomic	C <sub>3</sub>	1.8 or 2.5	47
Carbon trichloride	CCl <sub>3</sub>	≥2.10	29
Chlorine	Cl	3.75 ± 0.09 3.71 ± 0.05 3.82 ± 0.06 3.65 ± 0.01	97 80 12 91
Chlorine monoxide	ClO	2.90	12
Chlorine dioxide	ClO <sub>2</sub>	3.42	12
-----	ClO <sub>2</sub> F	≥2.7	52
Chlorine trioxide	ClO <sub>3</sub>	3.96	12
Chlorine tetraoxide	ClO <sub>4</sub>	5.81	12
Cyano	CN	3.2 ± 0.2 3.6 ± 0.4	38 12

<sup>a</sup>Approximate values shown in parentheses.

TABLE III.- ELECTRON AFFINITY VALUES - Continued

Name	Formula	Energy, (a)	Reference
-----	C <sub>3</sub> N	2.4	37
Ethyl	C <sub>2</sub> H <sub>5</sub>	0.9	88
Fluorine	F	3.58 ± 0.09 3.45 ± 0.05 3.62 ± 0.08 3.50	97 80 12 18
Hydrogen	H	0.747	11
Hydrogen sulfide	H <sub>2</sub> S	1.11 ± 0.08	99
Hydroperoxy	HO <sub>2</sub>	3.03	12
Hydroxyl	OH	2.8 ± 0.2 2.17	28 12
Iodine	I	3.076 ± 0.005 3.13 ± 0.12 3.19 ± 0.05 3.23 ± 0.06 3.17 ± 0.07	102 22 80 12 97
Lithium	Li	0.82 0.54	18 12
Mercury	Hg	1.54	12
Methyl	CH <sub>3</sub>	(1.08) 1.1	9 88
Methylidyne	CH	(1.6) 0.9	12 9
Nitrogen dioxide	NO <sub>2</sub>	1.62	12
Nitrogen trioxide	NO <sub>3</sub>	3.88	12
Oxygen	O	1.465 ± 0.005	24

<sup>a</sup>Approximate values shown in parentheses.

TABLE III.- ELECTRON AFFINITY VALUES - Concluded

Name	Formula	Energy, ev (a)	Reference
Oxygen, diatomic	O <sub>2</sub>	0.15 0.87 ± 0.12 0.46 ± 0.02	36 12 74
Ozone	O <sub>3</sub>	2.9	12
Phosphorus	P	0.77	18
Potassium	K	0.69	12
n-Propyl	n-C <sub>3</sub> H <sub>7</sub>	0.7	88
Selenium monohydride	HSe	1.08	9
Silicon	Si	1.46	18
Sodium	Na	0.47	18
Sulfur	S	2.15 2.07 ± 0.07 2.08 ± 0.02	18 73 99
Sulfur pentafluoride	SF <sub>5</sub>	3.39	19
Sulfur monohydride	SH	2.60 2.30 ± 0.04 1.65	12 99 9
Sulfur monoxide	SO	1.52 to 2.56 0.74	9 92
Sulfur dioxide	SO <sub>2</sub>	2.80	12

<sup>a</sup>Approximate values shown in parentheses.